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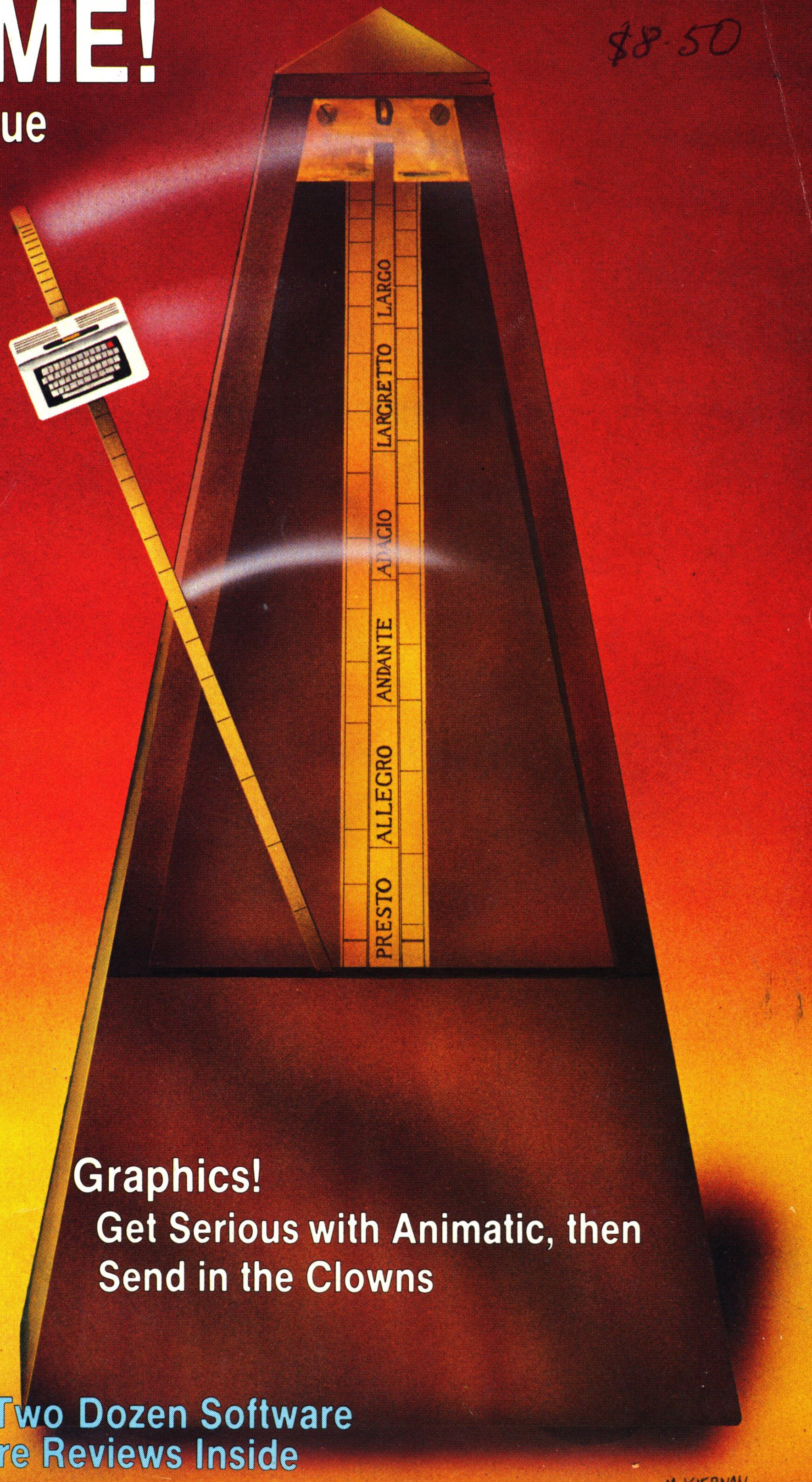
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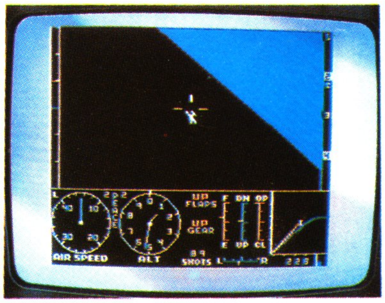

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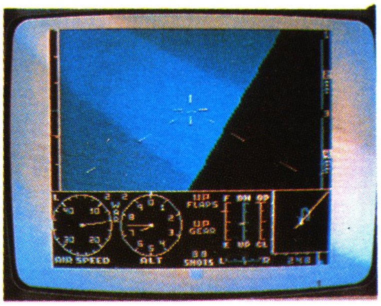

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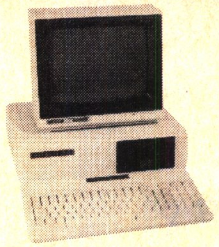

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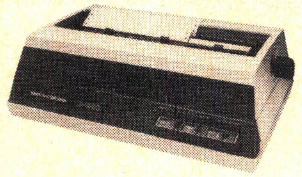

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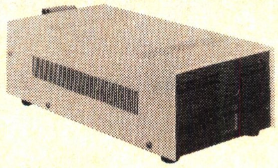

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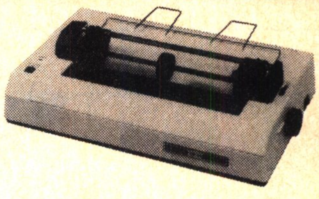

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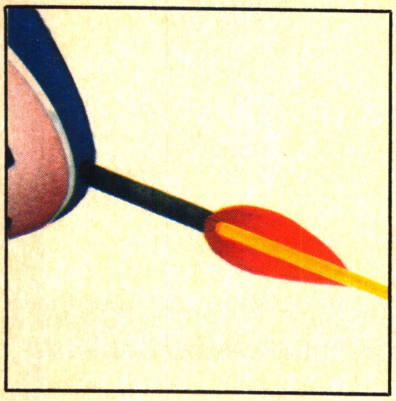

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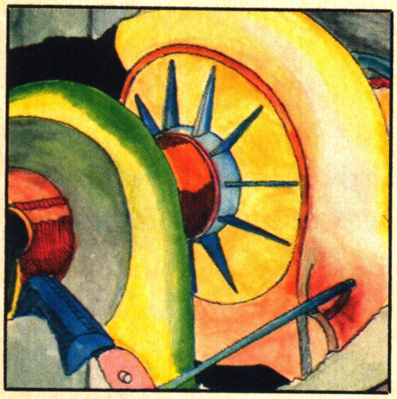

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📼 The small cassette tape symbols beside features and regular columns indicate that the program listings with those articles are on this month's RAINBOW ON TAPE, ready to CLOAD and RUN. For full details, check our RAINBOW ON TAPE ad on Page 248.

NEXT MONTH: A red-letter issue! Join us in July for our Fourth Anniversary Jubilee. We'll spark some fireworks with "The Ultimate Program" — a tribute to some superlatives of humankind by the talented Bob Tyson. Our birthday issue will also include Bob and Dan Delbourgo with graphics, Dennis Weide with a BASIC program for loading ML listings *without* an editor/assembler, and Jorge Mir will present a helpful tutorial on using the ECB statement INSTR. Colin Stearman will put you "on the right track" by showing how to make use of all 40 or 80 tracks on your disk drive, and make CoCo use both sides of a double-sided drive. Pace yourself with a rapid reading program, learn the rules of soccer with *Soccer Instructor*, and for the Fourth of July, we'll celebrate with a Musicfest program of traditional patriotic songs.

Along with other useful features, including a complete index to the past year of RAINBOW, there'll be our usual array of games, reviews and other anniversary surprises. Don't miss THE RAINBOW for more information on the CoCo than is available anywhere else!

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The RAINBOW
June 1985 Vol. IV No. 11

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LETTERS TO THE RAINBOW

'Return' Envelope

Editor:

First, a quick note to Dale Reed ("Letters To Rainbow," March 1985) . . . Instead of retyping a program like his *No Ghosts* (or if he just wants to run it before `CSAVE`ing it to check it out), just type `POKE 65494,0` in direct mode to return CoCo to normal speed.

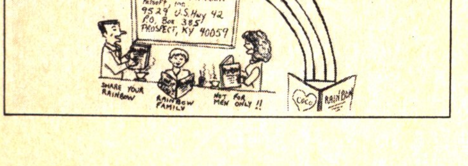
I am a beginning "CoCo-nut" and feel good that I can pass on some of my self-taught knowledge. RAINBOW has been a blessing in my quest for CoCo knowledge!

Second, I am saving to buy a printer. I'd love to hear from anyone with comments on printers — advice on which ones to consider, which ones to avoid, best deals, etc. Also, does anyone have any old, unobtainable issues of RAINBOW they would like to share or sell? Please write to me at 964 Rt. 518, 08558.

Finally, I cannot resist commenting on Mr. Bungay's winning sexist "Envelope Of The Month" [March 1985, Page 9]. Since his envelope was a "winner" am I to assume RAINBOW's attitude as a whole is also sexist?! Please take note of my envelope in response to this. I do not claim to be an artist, however, I think my point is well made. I resisted the temptation to portray an angry-looking husband while his wife paid more attention to THE RAINBOW than to him!

Judy Leo
Skillman, NJ

Editor's Note: See the article by Ed Ellers in the May 1985 Printers Issue of THE RAINBOW, Page 178 for a comparison on printers. Also the May 1984 issue has an article by Tom Nelson, "A Primer On Printers," Page 288.



HINTS AND TIPS

Editor:

I notice a disclaimer concerning the Dragon computer on the RAINBOW ON TAPE order form. Mark Randall, in California, has a program that used to be sold by Tano that will convert about 95 percent of THE RAINBOW programs for Dragon use. You will find Mark listed from time to time in your BBS section under Color America in Covina, Calif. Since I have three CoCos and three Dragons, I find it very useful.

Ray Chasse
Studio City, CA

DEFAULT DEFLECTION

Editor:

CoCo Max is by far the best graphics program on the market for the Color Computer, but I found that its exclusive use of the default extension /MAX limited the use of graphics pictures developed on other programs such as *Graphicom, Micropainter,* etc.

By using the following pokes, you can change the default extension to /BIN. Before using the pokes, it is recommended that a backup be made. Add these pokes to the BASIC loader.

```
POKE &H570B,&H42:
POKE&H570C, &H49:
POKE&H6900,&H49:
POKE &H6901,&H4E:
POKE&H6989,&H42
```

R.S. Gilmer
Miami, FL

TWO POKES TO COMPATIBILITY

Editor:

I thought some of your readers might be interested in a couple of pokes to make the older *Telewriter-64* compatible with Disk 1.1 BASIC.

I recently had to replace my Disk 1.0 ROM with Disk 1.1 ROM and found my version of *Telewriter* would no longer work. I disassembled the program and found where it called Disk 1.0 BASIC. I then found the proper address it should call with Disk 1.1 BASIC. Here are two pokes which will modify *Telewriter* to call the correct routine for Disk 1.1 BASIC.

```
POKE&H22E1,&HCA:
POKE&H22E2,&H67
```

These could be included in the BASIC loader program after it loads the *TW64/BIN* file or the binary file could be permanently modified by loading it, typing in the pokes directly and saving it. The start, end and execute addresses are &H1E28, &H40EB and &H1E28, respectively.

R.D. Smith
Eugene, OR

THE '?' IS THE ANSWER

Editor:

I entered the *MoCalc* spreadsheet program from the April 1984 [Page 186] issue of RAINBOW, and found it a valuable addition to my software library. Mr. Whittom's addition to it in the April 1985 issue ["Letters To Rainbow," Page 6] prompted me to write you with my enhancement.

I have found it annoying, after not using a particular program for a period of time, to forget the commands needed to utilize the program. The result is to frantically search for the article in past issues.

I have attempted to remedy this situation in *MoCalc*. By pressing '?', the function keys will be displayed on the screen for viewing. By pressing 'U' (update), the original spreadsheet is returned to the screen.

```
255 IFL$=CHR$(63) THEN 1500
 1500 PRINT@99,"CELL ENTRY <G>
      X,Y
 1510.PRINT@131,"FUNCTION ENTRY
     <F> X,Y
 1520 PRINT@163,"FUNCTION VIEW
      <V>
1530 PRINT@195,"MOVE ML,
     MR,MU,MD
1540 PRINT@259,"SAVE-LOAD <S>
     <L>
1550 PRINT@291,"PRINT <P>
1560 PRINT@452,"PRESS <ENTER>
     TO CONTINUE";:EXEC&HA171
1570 GOTO 170
```

I hope this addition will be of use to other *MoCalc* users.

Michael S. Kovach
Lakeview, NY

FIRST CHARACTERS FIRST

Editor:

Here is a short program to correct the printer routine in 1.1 BASIC, which causes the first character in a line to be missed occasionally.

```
10 DATA 52,4,214,111,43,3,53,4,
   57,246,255,34,84,37,250,53,4,57
20 L=&H01DA  'STORED IN CASSETTE
   BUFFER
30 FOR I=1TO18:READ A:POKE
   L,A:L=L+1:NEXT
40 POKE 360,1:POKE 361,218
```

This routine checks to see if the printer is ready before a character is sent. Just add this routine to the beginning of your programs that use printer output, and those first characters will be in front.

Jerry Graham
Clovis, NM

BEATING THE SOCKS OFF PRINTER CONTROL CODES

Editor:

Please pass along a big *thank you* to Roland Portillo, March 1985 RAINBOW ["Home Financial Statement," Page 87]. His article gave me something no other author has done: He included what his printer control codes were for and where in the program they could be found. This beats the socks off the rest of the programs I have tried to figure out; in fact, unless you have access to many printer manuals, it's impossible!

Recently I acquired an Olivetti Jet Ink Printer — it's good so far, but if anyone else out there has one and is having as much fun as I did pulling the control codes out of its manual, I sympathize. It took me two days of solid digging and a royal flash of intuition to get them (I think).

If anyone wants those control codes, please write me at 3123 - 138 Street SE, 98012.

Christine Terrio
Bothell, WA

INFORMATION PLEASE

Editor:

If I upgrade to 128K, will I be able to get more memory for games such as *The Trip* (August 1984 RAINBOW)? If I play it for more than an hour I end up with an OM Error and a ?MEM reveals 300 +- 100.

Jay Thomas
Great Falls, MT

Editor's Note: We haven't seen any software for expanding BASIC with 128K as of this time, but expect something to show up in the near future. As 128K modes are fairly recent, it will take a little time for software to evolve.

MACHINE LANGUAGE TRANSFORMER?

Editor:

I have been receiving your magazine for about a year now and I, like so many others, think it is the best.

I was wondering if there was a compiler for the CoCo that, instead of turning BASIC into machine language, would turn machine language into BASIC, either in BASIC code or in data. Is there such a thing? Anyone with an answer can reach me at 5473 Cardinal Road, 54124.

Paul MacArthur
Gillett, WI

Editor's Note: We know of no such program, other than a disassembler, which converts machine code to assembly language.

Editor:

I have just recently subscribed to your magazine. I love it! But there is one problem. I don't understand the double-check listing before each program. I was wondering if it might help me in correcting my programs. Thanks for the help.

David Brown
Joplin, MO

Editor's Note: See "Rainbow Info" on Page 129 of this issue for an explanation of the Rainbow Check Plus.

PMODE 4 SCREEN DUMP

Editor:

I have a 64K CoCo 2 and a DMP-110 printer. I want to know if you know of a short graphics screen dump for the PMODE 4.

Brad Williams
Springfield, IL

Editor's Note: Radio Shack sells a screen dump program called *BWDUMP* (Cat. No. 26-3121).

COMMUNITY CHOICE

Editor:

I am an avid RAINBOW fan. Recently, RAINBOW has carried a number of advertisers marketing video digitizers that convert TV camera signals to a Hi-Res CoCo screen. Considering the three versions carried in January: DS-69 by Micro Works, *Graphicom* by Computize and *VIDX* by GRAFX, which of these have been endorsed by the CoCo community? Have you seen any in operation? Are they easy to connect to a standard video camera?

James McDermott
Tyler, TX

Editor's Note: All of the digitizers you mentioned were on display at RAINBOWfest-Irvine and, as they are reviewed, we will try to distinguish between them. The DS-69 by Micro Works is used by several other programs, but since these devices are of recent design we'll have to see which stands the test of time with the community.

ROM PAK SWITCHER

Editor:

I have been an avid reader of THE RAINBOW for several years now and eagerly await each month's issue. There is one problem I have that someone may be able to help with.

Some of my programs are incompatible with Disk BASIC (especially Radio Shack's programs for kids). But with two young children that I want to have hands-on experience, removing and inserting the disk ROM Pak is a bit of a chore for them. It would seem to me that a switch could be wired into the ROM Pak that could enable/disable the Disk BASIC ROM. Maybe one of my fellow readers can come up with a way to do this.

David B. Lamon
Yuba City, CA

Editor's Note: Sounds like a job for Clay Howe. For starters, check his "Color BASIC ROM Switcher" article in the April 1985 RAINBOW, Page 98.

Editor:

I am a subscriber to RAINBOW and RAINBOW ON TAPE. I have a 64K Color Computer with two disk drives.

I am looking for a financial statement program that will list stocks and bonds, IRAs, mutual funds, savings account, check book balances, real estate holdings, cars, etc.

I am looking for something I could enter all of my assets and liabilities, keep them updated and print results on my DMP-200 printer.

Sam Cerami
Fort Lee, NJ

Editor's Note: We suggest you see our Business and Finance issues of RAINBOW, March 1984 and 1985.

SEPARATING THE AMATEURS FROM THE PROFESSIONALS

Editor:

Your Simulation contest grand prize winner, Christopher Pfeifer, is indeed a winner! I read his article on the program *Surface* and was thoroughly impressed with the detail and clarity in which it was written. I feel he is no longer in a class of amateurs but now rivals the professionals.

Is it possible to purchase the game *Surface* on tape?

Val Buncich
Cloquet, MN

Editor's Note: *Surface* is available on RAINBOW ON TAPE. You can use the order form on the insert card between pages 34 and 35 of this issue.

16K ADVENTURE GENERATOR

Editor:

I was wondering if anyone knows where I can get an Adventure generator for a 16K standard BASIC computer. If anyone can help me, write to 560 Adamsville Road, 16134.

Adam Benedict
Jamestown, PA

Editor:

My wife and I have been reading your magazine for two years and we love it. Our only complaint is we don't have enough time to do everything in THE RAINBOW. We recently started receiving RAINBOW ON TAPE so we have more time to use each program.

We would like to know if anyone has adapted the "CoCo Season's Greeting Cards" program, by Francis Kalinowski in the December 1984 issue to run on a Radio Shack DMP-200 printer. You can write to us at 1433 S. 78th Street, 53214.

My wife just entered the talking math program from the February 1985 issue ["Let CoCo Talk You Into A Better Education," Page 118]; we both enjoyed it a lot and would like to see more talking programs.

Has RAINBOW a BBS or are you thinking of starting one? We think it would be a good idea to transfer media.

Thanks very much for a great magazine.

Pat and Rob Brick
West Allis, WI

Editor's Note: While we have no BBS, nor any immediate plans to create one, that prospect is under consideration.

COMMENTS, PLEASE

Editor:

I am a new subscriber to THE RAINBOW, but rest assured that as long as I have my CoCo, I shall remain on your subscription list. RAINBOW is the best Color Computer magazine around. Keep up the good work!

I would appreciate any comments from readers who got a firsthand look at the *CoCo Max* at the RAINBOWfest. Write me at 1706 Lakewood Road S., Edmonton, T6K 3H5.

Azim Premji
Alberta, Canada

BOUQUETS

Editor:

I would like to publicly thank Custom Software Engineering Inc. for their patience and good service. They cleared my confusion about one of their ads and they gladly helped me get what I wanted. I hope all CoCo product companies follow their example. Thanks, guys!

Jorge E. Montes
Oklahoma City, OK

NOW THAT'S SERVICE!

Editor:

I'd like to present one perfect rose to Michael Norman of KRT Software.

I purchased a used copy of their F-16 instrument flight simulator through a classified ad from a third party as a present for my son. The tape sent to me was physically damaged and wouldn't load.

Although it was no fault of KRT, and in spite of giving birth to a 10 pound baby boy, Mrs. Norman still replaced the tape at no cost to me.

Allan B. Klar
Summer, WA

PRINTER PROBLEM

Editor:

I have owned and used a Gemini printer for some time and recently purchased a new one, called the 10X PC. Upon hooking the new printer up and using it, I discovered that Gemini had deleted the italics set from the printer's character set!

To some, this may seem to be a petty complaint but, when you already have so many files set up with a word processing program (such as *Telewriter-64* or *VIP-Writer*) that contain the italics, it is *real* disappointing to purchase a *new* printer only to find that it does not do what the *old* printer did!

Otherwise, the Gemini-10X PC is as capable and great as anyone could ask for.

Mark Hardee
Memphis, TN

Editor's Note: The Gemini-10X PC was a special version of the 10X made for use with IBM PC. The regular 10X continues to have italics.

CONTEST GROUPIE

Editor:

Being the novice CoCo user that I am, I would like to say that I am very excited again this year about RAINBOW's Adventure contest. The best part is that it gives novices and intermediates like me a chance not only to get a program published, but possibly to earn a prize. Keep the contest coming every year, please!

Tim Lehmann
Manhattan, KS

KUDOS

Editor:

You guys do it to me every time — or am I doing it to myself? I let my subscription lapse because I got tired of your writers forgetting that some of us are not interested in becoming Ph.D.s of programming. There are those of us who are very happy just working with BASIC. Not everyone is interested in moving on to machine language, PASCAL, OS-9, etc.

What I am trying to say is some of us are just having fun at a lower level. This doesn't mean we don't have a good grasp of computer technology, so please don't forget us.

Your magazine is really super. I promise not to let my subscription expire again.

My system is used for tax record keeping for my job (airline pilot) and management of rental properties. Also, it is tied into my ham radio for RTTY,CW, etc. The article in February 1985, *WEFAX* [Page 42] was very interesting. I hope you are going to print the changes to it for Radio Shack printers.

Again, thanks for a very good magazine for the CoCo.

Alfred R. Genola
Pittsburgh, PA

Editor's Note: If you have access to CompuServe, GO PCS 126 to enter the Color SIG and check the various help files to see how to download for the Radio Shack printers.

CLUBS, CLUBS, CLUBS

Editor:

If anyone is looking for a new CoCo club just for ages 5-16, here is the place to look. We won't have meetings, but will have a newsletter that will go out about every month. In it we'll have contests, programs and helpful hints on Adventures. You, the members, can submit these things. For more information please send a SASE to The CoCo Club, 11 Regal Drive, 07067.

Derrick Kardos
Colonia, NJ

Editor:

There is a new CoCo users group that meets at the Mercer County Main Branch Library on Rt. 1 in Lawrenceville. We meet on the first Wednesday of each month at 7 p.m. We discuss anything and everything from CoCo programming to communications with the CoCo, graphics to music, operating systems to hardware. We also try to arrange guest speakers each month.

For more information call The CoCo Enterprise BBS System at (609) 448-7768 or The Tardis BBS at (609) 448-1361 and leave messages with the Sysop. If you don't have a modem, call Rachel Sieverts at (609) 443-4032.

Michael Barcless
East Windsor, NJ

Editor:

I am starting a CoCo users group and would like to reach some prospective members through your magazine. Interested CoCo nuts can reach me at Box 407, RD 1, 13021, or call (315) 253-4054.

David Sullivan
Auburn, NY

Editor:

I am pleased to announce our new Dragon computer users group, called Dragonet. We are a nonprofit organization in support of the orphan Dragon 32 and Dragon 64 computers, with interests in OS-9, FLEX and other features of this fine personal computer. We have made numerous connections with Dragon user groups in Great Britain, and will be publishing a monthly newsletter to all subscribers.

All interested CoCo or Dragon users should write: Dragonet, 1011 Louisa Street, 70117.

Wayne H. Schnell
New Orleans, LA

Editor:

I am attempting to start a CoCo users group in the Green River-Rock Springs area. Anyone owning a CoCo (or thinking about buying one), please contact me at (307) 875-2106 or write me at 2025 Iowa Circle, 82935.

Stephen R. Slaton
Green River, WY

Editor:

Thank you for your help. We are corresponding worldwide with other CoCo clubs. Because of THE RAINBOW, we have friends in the U.S., Australia, West Germany, Belgium and Great Britain! Our club grew up. Our new address is: First CoCo Club of Hamburg, 2000 Hamburg 65, Op de Solt 53 a, West Germany.

Theis Klauberg
Hamburg, West Germany

BULLETIN BOARD SERVICE

Editor:

Are you an active shortwave radio listener? Would you like to talk to other shortwave radio listeners by way of computer? Contact me via FIDO BBS, No. 77 or via the UBIX BBS in Ohio or write to Colorado Shortwave Radio Listeners, P.O. Box 3434, 80161.

Rob Harrington
Littleton, CO

Editor:

I would like to inform your readers of the opening of a BBS in Orange County. The BBS will be online 24 hours a day, seven days a week. The board will be run by two-drive, 64K CoCo, with a 300 Baud Mark 10. Those who are interested may call (714) 847-5368 for the BBS, 847-2368 for voice.

Eric Wilson
Huntington Beach, CA

NOUVEAU COULEUR BBS

Editor:

I would like to announce a new BBS (in French) called L80C, which is dedicated to TRS-80 CoCo. Features include message base, electronic shopping, downloading, uploading, games and graphics. Readers may call the BBS anytime at (418) 872-8347.

Welly Denoncourt
Ancienne-Lorette, Quebec

Editor:

I would like to inform you of a few changes concerning my BBS, formerly the Pony Express BBS, (816) 232-2320. It has been named the Dragon's Lair. The BBS number is now (816) 232-4932. It has been updated to a Colorama Version 2.6. I plan on modifying it to take on a similarity of a dungeon Adventure. It is currently running only in the evenings.

Rick Drozd
St. Joseph, MO

Editor:

Please announce our BBS in the Watertown area. The system supports up- and downloading, games, and many other features. The Durant Club Bulletin Board is online 24 hours a day, seven days a week. The phone number is (414) 699-3214.

Durant Computer Club
Watertown, WI

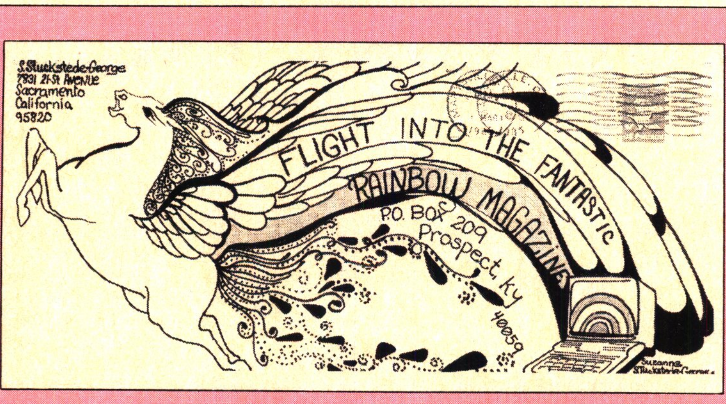
Editor:

Fort Worth has a dedicated CoCo BBS. Call TBBS Forth Worth, 300/1200 Baud, 24 hours daily, (817) 232-2087. It will even handle full speed dumps from *MIKEY-TERM*'s buffer!

Wayne Day
Fort Worth, TX

THE RAINBOW welcomes letters to the editors. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for purposes of clarity or space.

ARTS AND LETTERS



Envelope Of The Month *Suzanne Stuckslede-George*
Sacramento, CA

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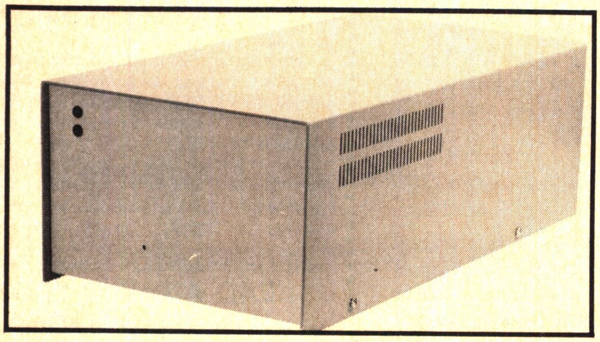

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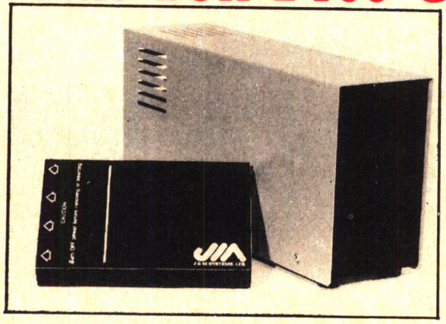

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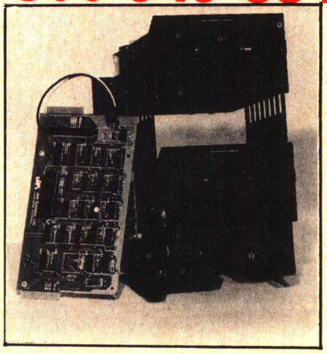

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PRINT #-2,

The daffodils are poking their heads out of the ground here in Kentucky this week, which means spring has finally sprung in these parts and by the time you read this, they will probably all have given way to the tulips, roses and other early summer flowers.

I like winter a lot because of the weather, but, like most everyone else, I love spring most of all. The willow tree in the back yard is getting green, the pin oaks are starting to bud and it is time for my annual hunt for someone to cut the grass (for now, at least) on a weekly basis.

Dr. Perry, who taught me more than a little bit of Greek and Roman mythology at the University of Alabama many years ago, would have some interesting observations on why human beings like spring so much. The rebirth of the world; the resurgence in spirit; the times when the gods frolicked atop Mount Olympus. Something like that — or all of those things. No doubt.

I'm sure all of this has a lot to do with it. But, after all, even though the electronic pulses in our CoCos could outrace Mercury (and certainly are less tiring than the runner on the Plain of Marathon), mythology, rebirth and the like are far from the computer world of binary and hexadecimal digits, `FOR/NEXT` loops and so on.

Or are they? You have read here before that I consider the computer in general — and the CoCo in particular — to be among the ultimate in many ways. And so, what would happen if we (as we really do do so often in our businesses and in our homes) applied our CoCos to some of the ultimate questions of the world and universe. What if we developed the "Ultimate Program"?

All of this is by way of saying that we're working on our big surprise for next month's anniversary issue. No, I will not say what it is. Those who know me best know how much I love surprises. But the code name for this one is "The Ultimate Program" and it involves a lot of ultimates — love and hate, war and peace — all of humankind's passions. And all on a grand scale. At least I hope so. Keep tuned.

Our "Ultimate Program" is both serious and fun. When the surprise is over, I'll have some more to say about it — and will certainly welcome your comments, too.

* * *

I have yielded to pressure. I often do. For years now, people have been asking me why we don't make up some binders to keep THE RAINBOW in.

I don't know. Because we *did* have some made up, and as soon as they came in, I grabbed six of them and started using them. Very nice. Very neat. And very organized (maybe that is why I never got any made before).

Our hard-cover binders for THE RAINBOW are red with gold lettering

Telewriter-64™

the Color Computer Word Processor

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THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

> *...one of the best programs for the Color Computer I have seen...*
> — Color Computer News, Jan. 1982

TELEWRITER-64

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24!! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPVII/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

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on both the front and spine. They are extra-thick and we're selling them in a set of two for $13.50 (plus $2.50 for shipping and handling). Because THE RAINBOW is so big, you need two binders to hold a whole year's worth of magazines.

But they look real nice, keep things organized and stand up on a shelf or desk without any trouble. If you're interested in them, see the ad in this month's issue on Page 47.

While on the subject of things we sell, we are really overwhelmed at the positive response to *The Rainbow Guide To OS-9*. Ken Kaplan, whose staff at Microware wrote OS-9, sent a most complimentary letter. And, interestingly, almost every other order we have received has been for the two-disk set of programs as well as the book. It is a resource you'll really want to have, especially in the years ahead.

* * *

I received a letter just the other day from an officer of a Color Computer club out West who had just received a letter from another club suggesting swapping software. The letter writer said that he and other members of his club resented the letter and that he wished I would take some steps to prevent it as much as possible.

We have been trying to do our part, but the bottom line is that *you* have to be the ones who stop software theft. It hurts every faction of the CoCo Community — including the users who end up having to spend more money than necessary to "cover" losses from piracy and the development of protection schemes.

I hope you will do your part to help us stop software theft. And, for the record, we do ask each club which is certified by us to agree to not allow "swapping" of software as a part of its bylaws. Incidentally, the bigger and better clubs are the ones which do not allow theft. Perhaps it is because they get into helping other members — and their communities — rather than having as a prime motive the ripping off of things for which they should be paying.

— Lonnie Falk

Metric Industries

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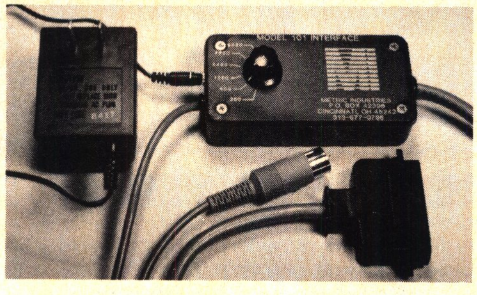

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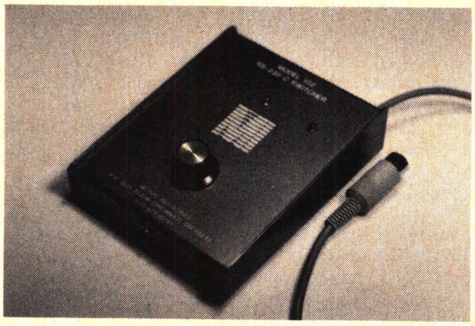
The Model 102 has 3 switch positions that allow you to switch your computer's serial output between 3 different devices (modem, printers or another computer). The 102 has color coded lights that indicate the switch position. These lights also act as power indicators to let you know your computer is on. Supplied with the 102 are color coded labels that can be applied to your accessories. The 102 has a heavy guage anodized aluminum cabinet with non-slip rubber feet.



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The Model 101 and 103 work with any standard parallel input printer including Gemini, Epson, Radio Shack, Gorillia, C.Itoh, Okidata and many others. They support basic print commands, word processors and graphic commands.

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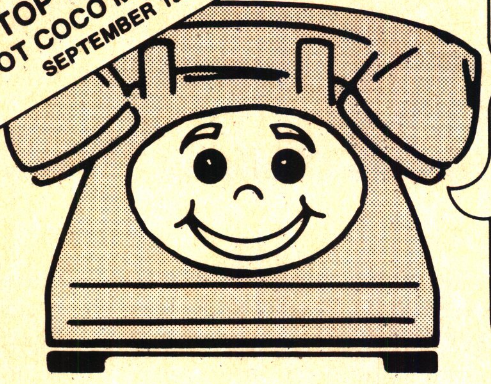

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SMOOTH WALKIN'

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BUILDING JUNE'S RAINBOW

Jerry Does Our Cover . . .
Lonnie Sees the Light . . .
And, Bob Accepts the Challenge . . .

Our change of tempo this month begins with our cover. It's the creation of Jerry McKiernan, a Beatles and blues, steel-stringed Harmony guitar picker, who's also RAINBOW's chief illustrator. The work of our resident gnome should be quite familiar to RAINBOW readers, as much of the artwork on our pages each month reflects his elfish qualities. He's produced so much for our inside pages as well as several covers for RAINBOW's sister publication, PCM, that I found it difficult to believe he hasn't previously done a cover for us. Jerry and I both had to double-check to confirm that, yes, this is his first for RAINBOW. It's an auspicious beginning, so, even though widely-acclaimed Fred Crawford, our regular cover artist returns next month, expect to see Jerry dipping his talented hand into all sorts of things, from his "CoCo Cat" cartoon feature to designing new additions to our Rainbow Bookshelf series.

While the rhythm is far-ranging in this our Sound and Music issue, with a little bit of everything from Chopin to sound synthesis, we're reserving some special fanfares for next month's Fourth Anniversary issue. After all, we're going to have the "Ultimate Program."

Did Lonnie Falk have the light of the enlightened in his eyes when he handed me the Ultimate Program memo? It seemed so to me. Maybe it was the gleam of recognition. You see, he had "that look." No, there was no light bulb visible above his head when he summoned me into his inner sanctum, but he'd clearly had a vision, and you could almost make it out if you peered deeply into his pupils. After reading his three-page, single-spaced memo, I still regarded his "latest" with a large measure of disbelief. As usual, though, he was not to be dissuaded.

While his immodest proposal for the Ultimate Program would seem to tax even the capabilities of that great computer room in the sky, Lonnie saw no reason whatsoever not to use the CoCo. His reasoning went along the lines that, given enough cassettes, everything that has ever happened could be saved to tape — or something like that. Just take it in byte-sized chunks, so to speak. He also saw no reason why we couldn't have it done in a month! That's when I called Bob Tyson.

Much to my surprise, Bob Tyson accepted the Anniversary Special assignment in stride. He was so matter of fact about it, I decided he must have seen the same light that shone in Lonnie's eyes. Write the Great American Program? Why not? Have it done in a month? No problem. Do it in under 32K? Probably wouldn't take that much. An assignment like that would fluster Clint Eastwood, but apparently not Cool Hand Bob. So, stay with us; there's a new genre of computer program in the making and it'll be one of our fourth anniversary gifts to the CoCo Community.

In the meantime, let's celebrate the sounds of CoCo and add to our musical skills as we explore this issue of THE RAINBOW. I'll conclude by breaking into my usual refrain: why not take note that a subscription to THE RAINBOW not only ensures that the beat goes on, but also saves you some 35 percent off the newsstand price. And, that's the name of that tune.

— Jim Reed

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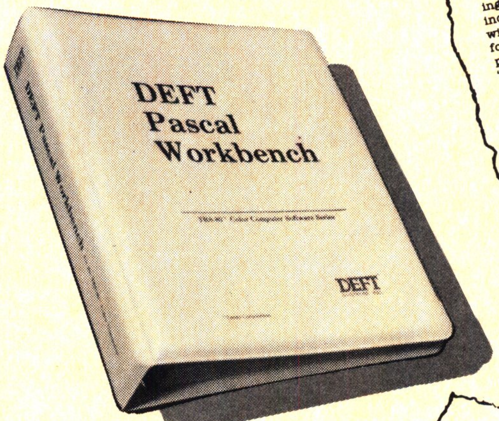

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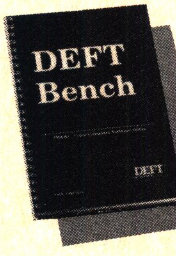

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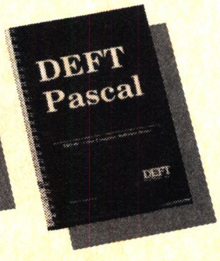

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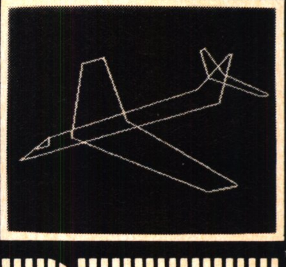

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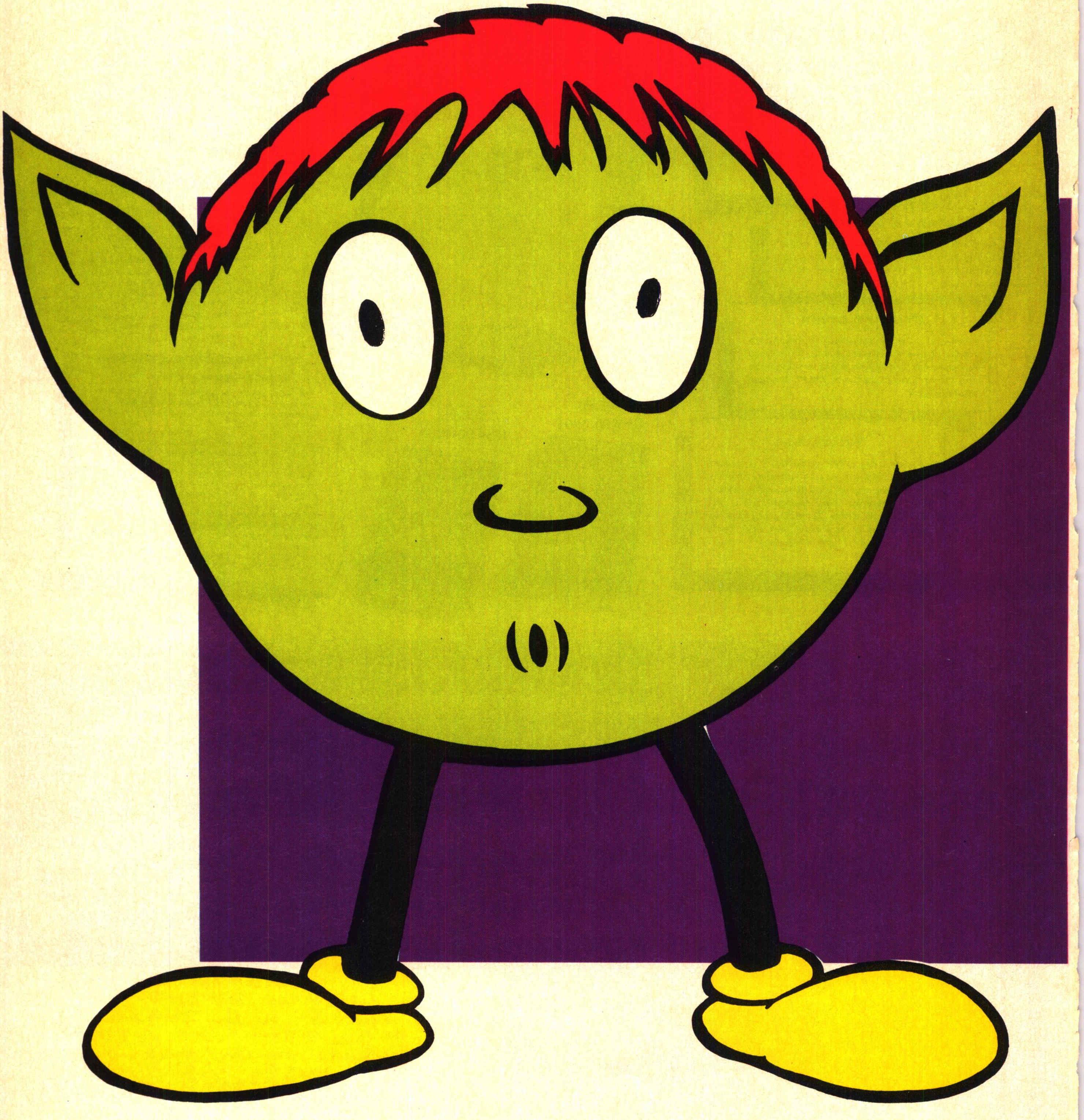


Learn Your Multiplication With

MULTO OF MARS

By Richard Ramella

"I don't have to learn the multiplication tables," my 9-year-old announced.

"Yes, you do," I said.

"No, I don't!"

"DO!"

"DON'T!"

My son and I often have such philosophical discussions.

"Don't you want to know why?" he asked between rounds five and six.

"OK, tell my why."

"Because when I grow up, they'll have wrist computers. If I want to know how much something times something is, I'll just punch it into the computer."

"That hasn't happened yet," I said. But in my heart I knew I was fibbing. There are already cheap digital watches with full calculator functions. Some of the newer ones are rumored to have spreadsheets that run up your arm.

"Besides," my son went on, "when I'm grown I'll probably be living on Mars." He paused, savoring the idea. "And my wrist computer'll have

---

(Richard Ramella has written two books and numerous articles on TRS-80 topics. He is a writer for a California hospital.)

word processing so I won't have to write. And it'll have a full-color screen that picks up any TV program I want."

"But what if you run into a Martian slime bunny and it vaporizes your wrist computer?" I said. "Then you won't be able to figure the coordinates to return to Mars Base One. You'll be lost out there! And all because you never learned the times tables!"

"Oh, get serious, Dad!"

I am a stern father. I sent my son to bed with only four peanut butter sandwiches and a quart of milk.

That night I wrote *Multo of Mars*. Multo is a computer character that makes a game of multiplication drills.

I remember learning the times tables in a kind of group agony called choral recitation. Thirty of us squirming fourth-graders droned answers as meaningless as telephone numbers we'd never call. I'm sure most of us managed to lapse into fantasies while mouthing the numbers. Like my son, I usually took a rocket ship to Mars, arriving well before "two times two is four."

The next afternoon, I introduced Multo to the pre-adolescent Earthling at my house. Multo helped but didn't do the entire job alone. Young Earthlings must write, recite and think about concepts they are learning, not just punch the answers into a computer.

Multo of Mars is a 16K Extended Color BASIC program. It uses Extended graphics and animation to teach fundamental multiplication skills ranging from "1 × 1" to "9 × 9." The times table is an educational must which is presented at about third grade level and should be mastered by about fifth grade.

Multo is a comic creature with tousled red hair, a huge head and big blue feet. Its mouth moves rapidly, then becomes a rectangle with a multiplication problem. Multo responds to correct answers in random, cheerful ways: dancing, smiling, crossing or blinking its eyes, and lifting an ear to emit colorful lightning bolts.

Play is simple. When a problem is presented, the player types the number answer and presses ENTER. A correct answer produces positive visual cues, and that particular problem is erased from the system. It may seem the same problem is presented more than once, but consider that "4 × 8" and "8 × 4" are a different sequence, and that "3 × 4" and "2 × 6" have the same answer.

A wrong answer offers non-judgmental correction. The mouth becomes a green rectangle, the correct answer is shown in white, and the problem is once again presented for the player to enter the answer just seen.

This problem is not taken out of the system. It returns in its random turn until the player gets it right. In this way, the pool of problems narrows to those which the learner needs to study.

Multo of Mars keeps score inwardly. About every seventh correct answer, a new letter of a building message appears on the screen. The encouraging message isn't completed until the 81st problem is answered correctly. When this happens, Multo springs its last surprise: a huge smile and an endless series of dancing, eye-crossing and blinking, and fireworks from the ear. The program must be broken into to stop the run.

If your computer does not accept the "speed poke" (`POKE 65495,0,`), this command should be taken out of Line 110.

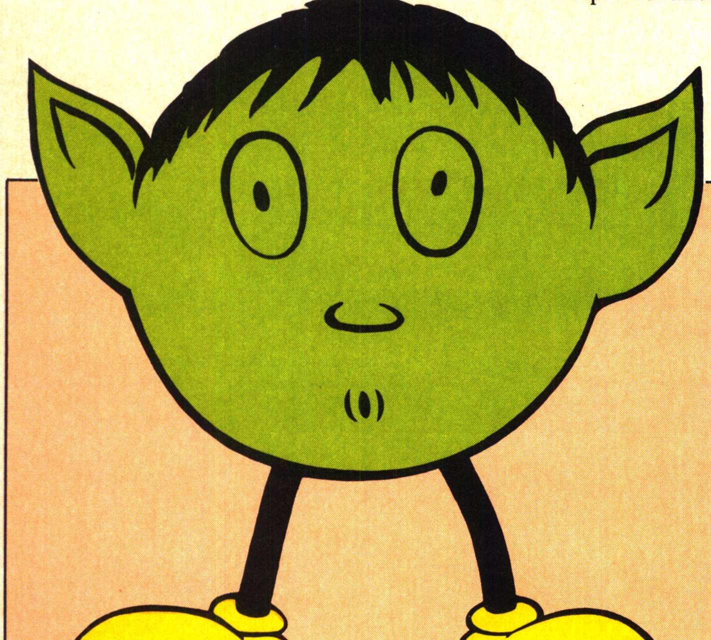
If a run of *Multo of Mars* is stopped before the entire series of problems is worked, the problems not yet solved may be seen by typing `FOR X=1 TO 81: PRINT A$(X);: NEXT` and pressing ENTER.

My advice to adults is to merely tell the young player how to play and leave the rest as a series of surprises. The building message, especially, tends to sustain interest even after the player has seen through the facade of what is after all a math drill.

The program has no sound. I removed the "boops" and "beeps" after a classroom test showed they tended to interfere with the work of students not at the computer.

Finally, I am not a teacher, but I know these things: Telling the answers to a computer, no matter how much fun it can be, is no substitute for writing the answers on paper. There is a learning connection between seeing, saying and writing, and learning the times tables is only the first step to learning how to multiply large numbers by each other — a process that requires pencil, paper and mind.

(Any inquiries regarding this program may be directed to Mr. Ramella at 1493 Mt. View Ave., Chico, CA 95926. Please include a SASE.)



The listing: `MULTO`

240	64	800	212
390	11	950	197
530	36	END	115
680	17		

```
100 REM * MULTO OF MARS * TRS-80
 EXTENDED COLOR BASIC / 16K / RI
CHARD RAMELLA
110 POKE 65495,0: CLEAR 900: DIM
 Z(1,21): ZL$="U8E5F5D2L10R10D6"
: GOTO 250
120 Z$="60200108296978 71": RETUR
```

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See reviews in:
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```
N
130 Z$="234040482959": RETURN
140 Z$="02202060607373757507070909
0979": RETURN
150 Z$="022020606073737575357578
786969292908": RETURN
160 Z$="000606765059": RETURN
170 Z$="70000004046464757577775959
59191908": RETURN
180 Z$="70202002020707292979797878
78757515": RETURN
190 Z$="00707009": RETURN
200 Z$="01101060607171737364641414
140303011405050808191969697878758
7564": RETURN
210 Z$="74141403030101101060607
1717878696919190B": RETURN
220 Z$="12721575": RETURN
230 Z$="00790970": RETURN
240 FOR H=1 TO LEN(Z$) STEP 4: L
INE(X+VAL(MID$(Z$,H,1)),Y+VAL(MI
D$(Z$,H+1,1)))-(X+VAL(MID$(Z$,H+
2,1)),Y+VAL(MID$(Z$,H+3,1))),PSE
T: NEXT: RETURN
250 PMODE 3,1: PCLS1: SCREEN 1,1
260 COLOR 3,1: LINE(0,0)-(255,20
),PSET,BF: COLOR 1,1
270 M$="U16R5F7E7R5D16L5U11G7H7D
11L5": DRAW"BM5,18;"+M$: PAINT(7
,15),4,1
280 DRAW"BM33,18;U16R5D11R8U11R5
D16L18": PAINT(35,15),4,1
290 DRAW"BM55,18;U16R5D11R13D5L1
8":  PAINT(57,15),4,1
300 DRAW"BM77,18;U11L7U5R19D5L7D
11L5": PAINT(79,15),4,1
310 DRAW"BM93,18;U16R18D16L18E1C
3E4C1U6R8D6L8": PAINT(95,15),4,1
320 CIRCLE(125,11),8
330 DRAW"BM137,18;U10R3L6R3U3E3R
3F3"
340 DRAW"BM153,18;"+M$: PAINT(15
5,15),4,1
350 DRAW"BM183,18;U16R18D16L5U6L
7D6L5": DRAW"BM189,5;R5D4L5U4":
PAINT(185,15),4,1
360 DRAW"BM205,18;U16R17D10L6F6L
5H6L2D6L5": DRAW"BM211,5;R5D4L5U
4": PAINT(207,15),4,1
370 DRAW"BM227,18;U3R13U3L13U10R
18D4L13D3R15D9L18": PAINT(229,17
),4,1
380 DIM A$(81): C=1: D=81: FOR A
=1 TO 9: FOR B=1 TO 9
390 A$(C)=STR$(A)+"X"+STR$(B): C
=C+1: NEXT B,A
400 COLOR 2,1: CIRCLE(128,96),80
,,.7,.96,.55
410 DRAW"BM50,80;H25R35C1R135C2R
35G25": COLOR 4,1
420 R=75: FOR A=-R+10 TO R-10 ST
EP 2: G=R*R-A*A: Y=INT(SQR(G))
430 LINE(A+128,96-Y)-(A+128-(RND
(20)-10),96-Y+RND(25)),PSET: NEX
T: COLOR 2,1
440 FOR X=100 TO 156 STEP 56: CI
RCLE(X,70),20,,.6: CIRCLE(X,73),
5: NEXT
450 DRAW"BM117,85;F12E12": DRAW"
BM115,178;U27R30D27"
460 FOR X=100 TO 160 STEP 60: CI
RCLE(X,183),20,,.5: PAINT(X,185)
,3,2: NEXT
470 LINE(80,188)-(180,192),PRESE
T,BF: DRAW"BM85,188;R32C1R30C2R3
1"
480 FOR U=1 TO 5+RND(15): ER=1+R
ND(3)
490 Q1=Q: P1=P: P=RND(26): Q=RND
(0): CIRCLE(128,125),P,ER,Q: CIR
CLE(128,125),P1,1,Q1
500 NEXT U: CIRCLE(128,125),P,1,
Q
510 COLOR 2,1: R1=0: C$="": E=RN
D(81): IF D=0 THEN 730
520 IF A$(E)="" THEN 510
530 F=VAL(LEFT$(A$(E),2)): G=VAL
(RIGHT$(A$(E),1))
540 LINE(91,115)-(169,135),PSET,
B: X=95: Y=120: A$=A$(E)+"=": GO
SUB 750
550 W$=INKEY$: IF W$=CHR$(13) TH
EN 570 ELSE IF W$="" OR INSTR("1
234567890",W$)=0 OR R1=2 THEN 55
0 ELSE A$=W$: C$=C$+W$: H1=VAL(C
$): GOSUB 750: R1=R1+1
560 GOTO 550
570 IF H1=F*G THEN FOR T=1 TO 50
0: NEXT T: GOTO 590
580 GOSUB 810: R1=0: E1=1: C$=""
: GOTO 530
590 LINE(91,115)-(169,135),PRESE
T,BF: KL=20+RND(30): CIRCLE(128,
115),KL,2,.5,0,.5
600 GH=RND(10): ON GH GOSUB 840,
860,910,970: IF GH>4 THEN FOR T=
1 TO 600: NEXT T
610 CIRCLE(128,115),KL,1,.5,0,.5
620 IF D=74 THEN DRAW"BM15,85;D5
F5E5U5D5G5D6"
630 IF D=67 THEN DRAW"BM15,103;R
10D12L10U12"
640 IF D=60 THEN DRAW"BM15,118;D
12R10U12"
650 IF D=53 THEN DRAW"BM15,151;"
+ZL$
660 IF D=46 THEN DRAW"BM15,166;U
12R10D6L10R3F6"
```

```
670 IF D=39 THEN DRAW"BM25,181;L
10U6R5L5U6R10"
680 IF D=32 THEN DRAW"BM235,101;
"+ZL$
690 IF D=25 THEN DRAW"BM235,123;
R10L10U12R10"
700 IF D=18 THEN DRAW"BM235,139;
U12D6R10U6D12"
710 IF D=11 THEN DRAW"BM235,154;
"+ZL$
720 IF D=4 THEN DRAW"BM235,169;U
12F6E6D12"
730 IF D=0 THEN DRAW"BM235,185;U
12R10D6L10": GOTO 990
740 IF E1=1 THEN E1=0: GOTO 480
ELSE A$(E)="": D=D-1: GOTO 480
750 FOR P=1 TO LEN(A$): Q$=MID$(
A$,P,1)
760 K=ASC(Q$): IF K=61 OR K=88 O
R K>47 AND K<58 THEN 770 ELSE 80
0
770 IF K=61 THEN GOSUB 220 ELSE
IF K=88 THEN GOSUB 230 ELSE IF K
=48 THEN GOSUB 120 ELSE IF K=49
THEN GOSUB 130 ELSE IF K=50 THEN
 GOSUB 140 ELSE IF K=51 THEN GOS
UB 150 ELSE IF K=52 THEN GOSUB 1
60 ELSE IF K=53 THEN GOSUB 170
780 IF K=54 THEN GOSUB 180 ELSE
IF K=55 THEN GOSUB 190 ELSE IF K
=56 THEN GOSUB 200 ELSE IF K=57
THEN GOSUB 210
790 GOSUB 240: X=X+12: NEXT P: R
ETURN
800 NEXT P: RETURN
810 LINE(91,115)-(169,135),PSET,
BF
820 COLOR 1,1: X=95: Y=120: A$=A
$(E)+"="+RIGHT$(STR$(F*G),2): GO
SUB 750
830 FOR T=1 TO 1000: NEXT T: LIN
E(91,115)-(169,135),PRESET,BF: C
OLOR 2,1: RETURN
840 FOR U1=1 TO 5+RND(10): FOR X
1=100 TO 156 STEP 56: PAINT(X1,6
6),RND(2)+2,2: NEXT X1,U1
850 PAINT(100,66),1,2: PAINT(156
,66),1,2: RETURN
860 FOR HG=1 TO 3+RND(5): C1=RND
(2): IF C1=1 THEN L1=79 ELSE L1=
139
870 GET(L1,170)-(L1+56,192),Z
880 FOR J1=170 TO 170-(RND(8)*2)
 STEP -2: GOSUB 900: NEXT J1
890 FOR J1=J1 TO 170 STEP 2: GOS
UB 900: NEXT J1,HG: RETURN
900 PUT(L1,J1)-(L1+56,J1+22),Z:
RETURN
910 GET(205,50)-(230,80),Z
920 FOR J1=50 TO 30 STEP -1: GOS
UB 960: NEXT J1
930 FOR T=1 TO 5+RND(10): P=3+RN
D(10): P$=RIGHT$(STR$(P),1): PL$
="E"+P$+"F"+P$: PL$=PL$+PL$+PL$:
 CO$=STR$(1+RND(3))
940 F$=";BM217,52;": DRAW "C"+CO
$+F$+PL$: FOR T1=1 TO 100: NEXT
T1: DRAW"C1"+F$+PL$: NEXT T
950 FOR J1=30 TO 50: GOSUB 960:
NEXT J1: COLOR 2,1: RETURN
960 PUT(205,J1)-(230,J1+30),Z: R
ETURN
970 FOR WR=1 TO RND(5)*2: IF WR/
2=INT(WR/2) THEN T1=1: T2=2 ELSE
 T1=2: T2=1
980 CIRCLE(100,73),5,T2: CIRCLE(
113,70),5,T1: CIRCLE(156,73),5,T
2: CIRCLE(145,70),5,T1: FOR YT=1
 TO 10: NEXT YT,WR: RETURN
990 FOR X=85 TO 115: CIRCLE(128,
X),40,4,.5,0,.5: NEXT X
1000 FOR X=105 TO 113: CIRCLE(12
8,X),32,1,.4,0,.5: NEXT X
1010 GH=RND(4): ON GH GOSUB 840,
860,910,970: GOTO 1010
1020 END
```

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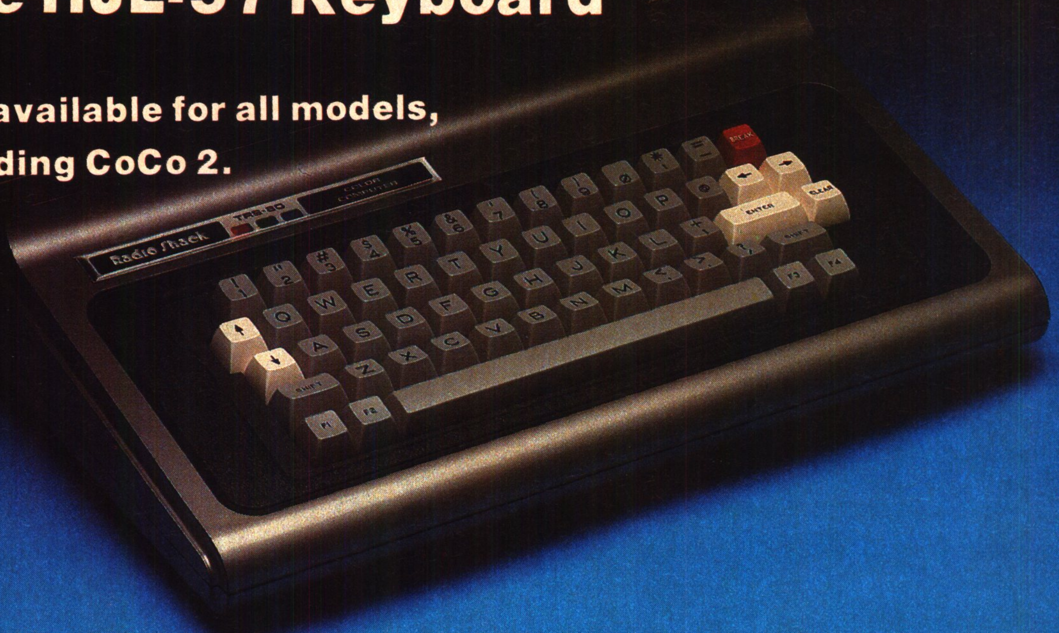

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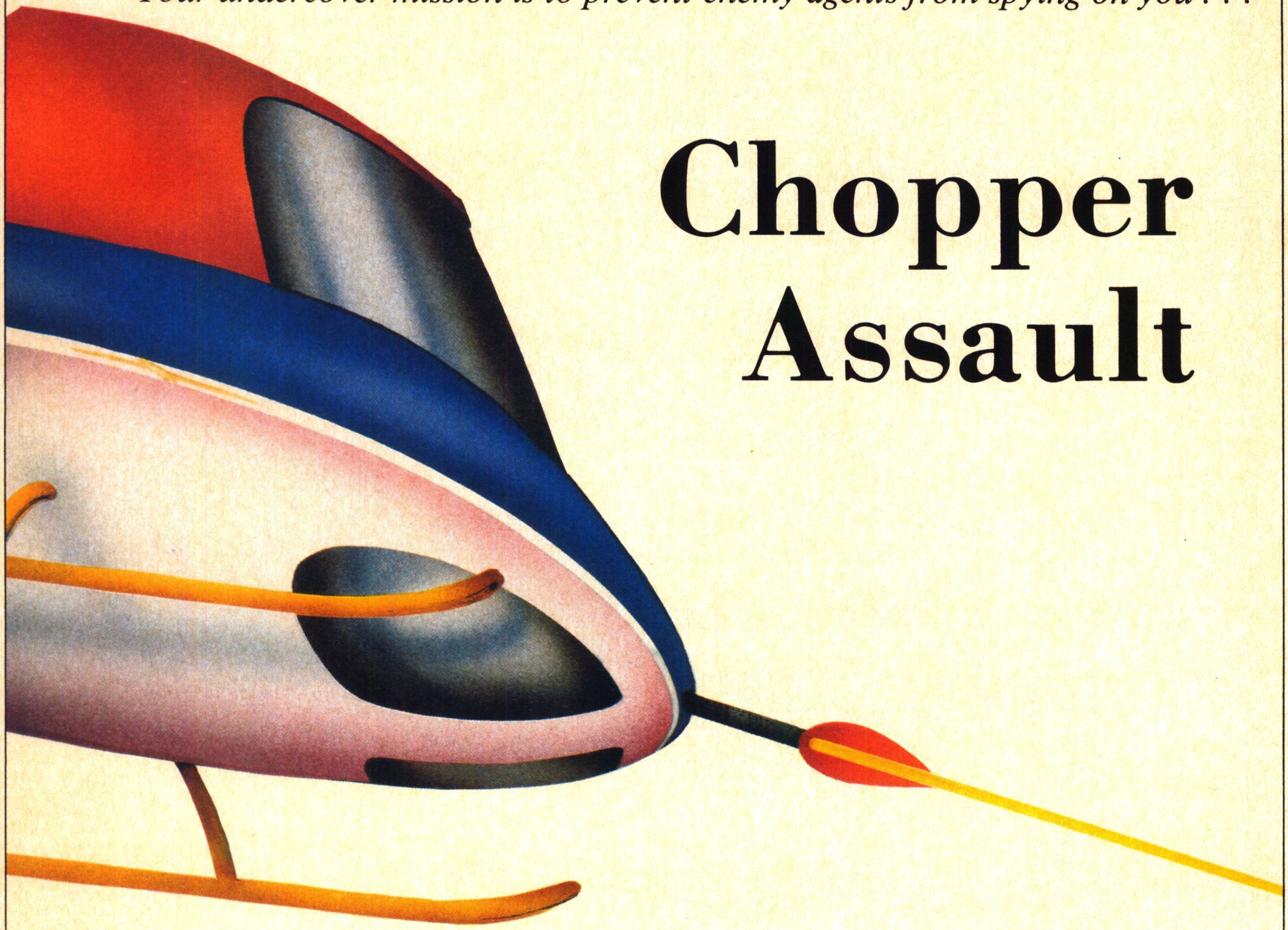
Dealer inquiries invited.

Your undercover mission is to prevent enemy agents from spying on you . . .

Chopper Assault



By Jens Petersen

A 16K ECB Color Computer game, *Chopper Assault* requires a joystick to play. The object is to stop enemy spies from gathering too much information; if they do, you die!

First `CLOAD` and `RUN` the program, then you will be asked for either levels 1, 2 or 3, depending on your level of play. Type in your name and press `ENTER`, which will then show the title screen. Press the firebutton to start the game.

You will see from inside your own helicopter your four cannon sites, with a box in the center of the sites showing where the cannon will shoot. Your timer is at the top, indicated by a line or bar. Your score is there too, in the middle. You move the box, or center site, around the screen with the joystick.

You have five shots at the enemy; when he gathers enough information to leave, another comes to take his place. If you shoot one, your score increments by the amount of time left. If your score is above the high score, the program displays some graphics to show you this, but it can only happen once in your game.

You die if your time runs out, meaning that the enemies have gathered enough information to destroy you. If you're dead, the program goes into text and you see your name and score, and the top three names and scores. Press the firebutton to play again or press 'Q' to quit. (*Chopper Assault* does not work on a disk-based system.)

If you have any questions about this program, Jens may be reached at 6180 Baffin, Brossard, Quebec, Canada J4Z 2H8, phone (514) 678-4205.

(Jens Petersen is 14 years old and goes to Centennial Regional High School in Brossard, Quebec. He likes to bike, swim, fish and compute on his CoCo.)

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Old English Cartoon

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Gay Nineties

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uvwxynoldsbabcde

All typestyles on Tapes 2, 3, 4, 5, and 6 include Standard (1/2 inch), Reversed, Reduced, and Reduced-Reversed unless otherwise noted.

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Business Antique

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Tape 5: Star **Hebrew**

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*These disks of additional typestyles are available for **$49.95** each.* They are not compatible with the **CoCo Calligrapher** typestyles or program. OS-9 typestyle disk must be used with the **OS-9 Calligrapher.**

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Disk 2 - OS-9 version of all type styles on Tapes 4, 5 and 6.

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520	125
640	73
740	206
900	123
END	98

The listing: CHOPPER

```
10 '******CHOPPER ASSAULT*******
20 'JENS PETERSEN  JANUARY14/84*
30 '****************************
40 POKE65495,0
50 CLEAR300:DIMH(18),J(18),EX(10
)
60 A$(0)="BDER2FD4GL2HU4":A$(1)=
"BD6BR2RNRU6G":A$(2)="BDER2FDGL2
GD2R4":A$(3)="BDER2FDGNLFDGL2H":
A$(4)="BR4ND6G3R4":A$(5)="BRNR4D
3ER2FD2GL2H":A$(6)="BRNR3GD4FR2E
UHL2":A$(7)="R4G3D3"
70 A$(8)="BRR2FDGFDGL2HUEHUE":A$
(9)="BD6R2EU4HL2GDFR2"
80 GOSUB780:SC=0
90 GOTO210
100 T$=STR$(SC)
110 COLOR5,0:LINE(104,3)-(D,13),
PSET,BF
120 D=106
130 FORT=2TOLEN(T$)
140 E$=MID$(T$,T,1)
150 E=VAL(E$)
160 DRAW"C0BM"+STR$(D)+",5"+A$(E
)
170 D=D+7
180 NEXT
190 COLOR5,0
200 RETURN
210 PMODE2,1:COLOR0,5:PCLS:SCREE
N1,1
220 D$="NR5D10R5BU10BR3D10U5R5NU
5D5BU10BR3D10R5U10L5BR8ND10R5D5L
5BR8BU5ND10R5D5L5BR8BU5NR5D5NR3D
5R5BU10BR3ND10R5D5L5RF4D":DRAW"B
M92,30"+D$
230 DR$="ND10R5D5NL5D5BR8BU10L5D
5R5D5L5BR12BU10L3D5R3D5L3BR8U10R
3D5NL3D5BR4NU10R5U10BR4D10R3BR6U
10NL2R2":DRAW"BM92,44"+DR$
240 DRAW"BM20,120D10R5U5L5BR8D5R
5NU5D5BR12R5D10G2L3H2BR11BU10NR4
D6NR3D6R4BU12BR4ND12F6ND6U6BR4NR
4D6R4D6NL4BR12BU12ND12R4D6NL4BU6
BR4NR4D6NR3D6R4BU12BR4R2NR2ND12B
R6NR4D6NR2D6R4BU12BR4ND12R4D6L4R
1F3D3BU12BR4NR4D6R4D6NL4BU12BR4N
R4D6NR2D6R4BU12BR4ND12F6ND6U6
250 DRAW"BM160,150D2BR4BU2R4D12L
4U6NR4U6BR8D6R4NU4D6"
260 P=PEEK(65280):IFP=254ORP=126
THEN270ELSE260
270 PMODE4,1:PCLS:SCREEN1,1:COLO
R5,0:FORCF=1TO2:Q1=127:Q2=96:Q3=
96:FORT=127TO0STEP-3:Q1=Q1+3:Q2=
Q2+2.2:Q3=Q3-2.2:LINE(T,Q3)-(Q1,
Q2),PSET,B:NEXT:COLOR0,0:NEXT:CO
LOR5,0
280 PMODE0,1:SCREEN1,1
290 PMODE4,1:PCLS
300 DRAW"BM50,50R4NR4D2LG2FR4EH2
":PAINT(53,54),5,5
310 GET(50,50)-(58,55),H,G:GET(1
00,100)-(108,105),J,G:PCLS:FORX=
1TO20:PSET(RND(10)+100,RND(10)+1
50,5):NEXT:GET(100,150)-(110,160
),EX,G
320 PCLS:SCREEN1,1
330 V1=RND(191):V=RND(255):O1=10
0:O2=100:EM=200:AS=127:SD=96:DS=
96
340 LINE(0,0)-(255,16),PSET,BF
350 COLOR0,1
360 A=0:B=0
370 FORT=1TO2
380 A=A+1:B=B+1
390 DRAW"BM"+STR$(A)+","+STR$(B)
+D$
400 NEXT
410 A=200:B=0:FORT=1TO2:A=A+1:B=
B+1:DRAW"BM"+STR$(A)+","+STR$(B)
+DR$:NEXT
420 D=104:GOSUB100
430 SCREEN1,1
440 X=RND(5)+2:X1=RND(5)+2
450 EM=EM-F3
460 IFEM<5THEN760ELSELINE(200,14
)-(EM,14),PRESET
470 JH=JOYSTK(0):JV=JOYSTK(1)
480 WE=JH*255/63
490 EW=JV*191/63+16+5
500 IFWE<5THENWE=5ELSEIFWE>250TH
ENWE=250
510 IFEW>191THENEW=191ELSEIFEW<1
9+5THENEW=19+5
520 LINE(AS-5,SD-5)-(AS+5,SD+5),
PRESET,B
530 LINE(0,SD)-(8,SD),PRESET:LIN
E(255,DS)-(247,DS),PRESET:LINE(0
,EW)-(8,EW),PSET:SD=EW:LINE(255,
EW)-(247,EW),PSET:DS=EW
540 LINE(AS,17)-(AS,22),PRESET:L
```

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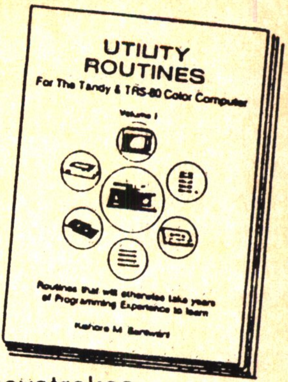
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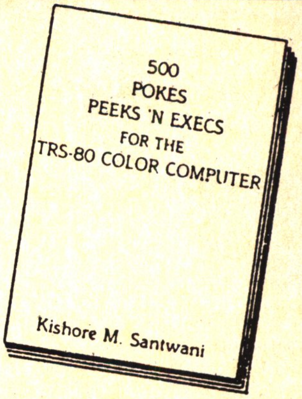

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```
INE(AS,191)-(AS,185),PRESET:LINE
(WE,17)-(WE,22),PSET:LINE(WE,191
)-(WE,185),PSET:AS=WE
550 LINE(WE-5,EW-5)-(WE+5,EW+5),
PSET,B
560 P=PEEK(65280):IFP=126ORP=254
GOSUB640
570 RN=RND(20):IFRN=1THENX1=-X1:
PLAY"L255V31O1:CD" ELSE IF RN=2T
HENX=-X:PLAY"L255V31O1;CD"
580 IFX4=>5THENFORT=1TO7STEP2:CI
RCLE(V+4,V1+3),T:NEXT:FORT=1TO7S
TEP2:CIRCLE(V+4,V1+3),T,0:NEXT:V
=RND(255):V1=RND(191):PLAY"L50O5
DGDGDGDGD":X4=0
590 V=V+X:IFV>247THENV=7ELSEIFV<
7THENV=247
600 V1=V1+X1:IFV1>185THENV1=24EL
SEIFV1<24THENV1=185
610 PUT(O1,O2)-(O1+8,O2+5),J,PSE
T:PUT(V,V1)-(V+8,V1+5),H,PSET:O1
=V:O2=V1
620 IFINKEY$="Q"THEN910
630 GOTO450
640 PRESET(WE,EW):PUT(V,V1)-(V+8
,V1+5),H,PSET:PH=PPOINT(WE,EW):L
INE(WE,22)-(WE,185),PSET:LINE(10
,EW)-(245,EW),PSET:LINE(WE,22)-(
WE,185),PRESET:LINE(10,EW)-(245,
EW),PRESET:PLAY"L255V31O1;12;11;
10;9;8"
650 IFPH<>0THEN660ELSEEM=EM-5:X4
=X4+1:RETURN
660 PUT(WE-5,EW-5)-(WE+5,EW+5),E
X,PSET
670 DRAW"C0BM72,3D4ND4R4NU4D4BR3
NU8BR4U8NL2R2BR3D5BD2D"
680 PLAY"L30V31O1;12;1;12;1;12;1
;12;1;L255O1;4;3;2;1;4;3;2;1;4;3
;2;1;4;3;2;1;4;3;2;1;4;3;2;1;4;3
;2;1;4;3;2;1":PUT(WE-5,EW-5)-(WE
+5,EW+5),J,PSET
690 SC=SC+EM:GOSUB100:EM=200
700 LINE(200,14)-(0,14),PSET
710 V=RND(255):V1=RND(191):IFSGN
(X)=-1THENX=RND(5)+2ELSEX=(RND(5
)+2)*-1
720 IFSGN(X1)=-1THENX1=RND(5)+2E
LSEX1=(RND(5)+2)*-1
730 IFSC>SC(1) THENIFGP<>1THENCO
LOR5,0:FORCF=1TO2:Q1=127:Q2=104:
Q3=104:FORT=127TO0STEP-3:Q1=Q1+3
:Q2=Q2+2:Q3=Q3-2:LINE(T,Q3)-(Q1,
Q2),PSET,B:NEXTT:COLOR0,0:NEXT:C
OLOR5,0:GP=1
740 DRAW"C5BM72,3D4ND4R4NU4D4BR3
```

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```
NU8BR4U8NL2R2BR3D5BD2D"
750 GOTO450
760 PLAY"L20V3101;6;5;4;3;2;1;L3
0;6;5;4;3;2;1;L50;6;5;4;3;2;1;L7
0;6;5;4;3;2;1;L90;6;5;4;3;2;1;L1
30;6;5;4;3;2;1;L200;6;5:4;3;2;1"
:FORT=1TO50:LINE(RND(255),RND(19
1))-(AS,SD),PSET:NEXT
770 GOTO910
780 CLS
790 PRINT@11,"CHOPPER":PRINT@32+
11,"ASSAULT":PRINT@32*2+7,"BY JE
NS PETERSEN"
800 PRINT@32*3,"PRESS LEVEL OF D
IFFICULTY"
810 PRINT@32*4,"1- BEGINNER":PRI
NT@32*5,"2- EXPERT":PRINT@32*6,"
3- PRO"
820 PLAY"L255V3101":FORT=1024TO1
535:Z=PEEK(T):IFZ>63THENPOKET,Z-
64:PLAY"1"
830 NEXT
840 A$=INKEY$:IFA$=""THEN840ELSE
IFVAL(A$)<1ORVAL(A$)>3THEN840
850 PLAY"L255V3101;1;2;3;4;5;6;7
;8;9;10;11;12"
860 PRINT@256,"name";
870 POKE282,0
880 INPUTNA$:IFNA$=""THEN860
890 POKE282,1
900 U7=VAL(A$)+2:F3=VAL(A$):RETU
RN
910 CLS
920 PRINT@64+11,"GAME OVER"
930 PRINT@0,"";:PRINTTAB(8)"CHOP
PER ASSAULT"
940 IFSC>SC(1)THENSC(3)=SC(2):NA
$(3)=NA$(2):SC(2)=SC(1):NA$(2)=N
A$(1):SC(1)=SC:NA$(1)=NA$
950 IFSC<SC(1)ANDSC>SC(2)THENSC(
3)=SC(2):NA$(3)=NA$(2):SC(2)=SC:
NA$(2)=NA$
960 IFSC<SC(2)ANDSC>SC(3)THENSC(
3)=SC:NA$(3)=NA$
970 PRINT@128+11,SC;NA$;
980 PRINT@192+10,"HIGH SCORES"
990 PRINT@256+10,SC(1);NA$(1);
1000 PRINT@288+10,SC(2);NA$(2);
1010 PRINT@320+10,SC(3);NA$(3);
1020 FORT=1024TO1535:Z=PEEK(T):I
FZ>63THENPOKET,Z-64
1030 PLAY"L255V3104;D":NEXT
1040 P=PEEK(65280):IFP=126ORP=25
4THEN80ELSEIFINKEY$="Q"THEN1050E
LSE1040
1050 CLS:CLEAR:POKE65494,0
```

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By Bernie Litton

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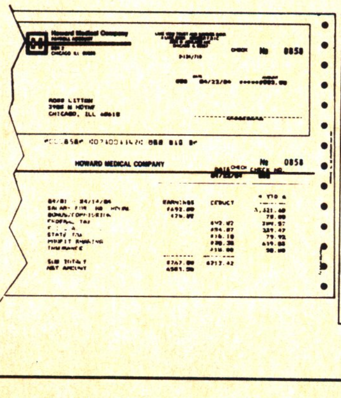

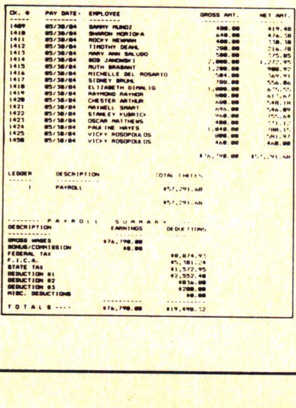

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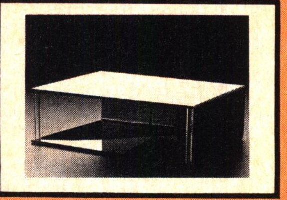

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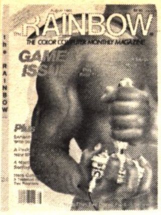

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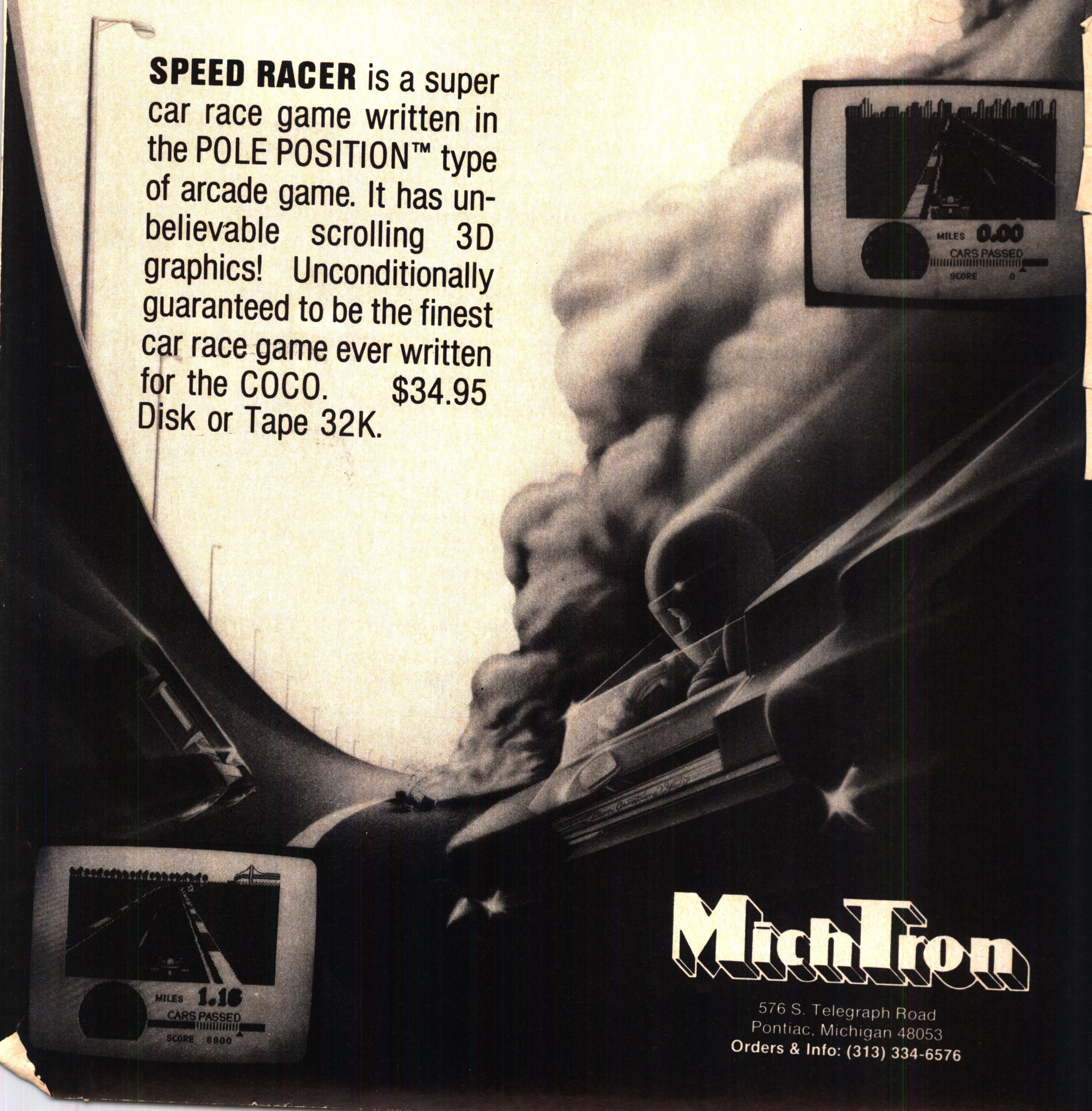
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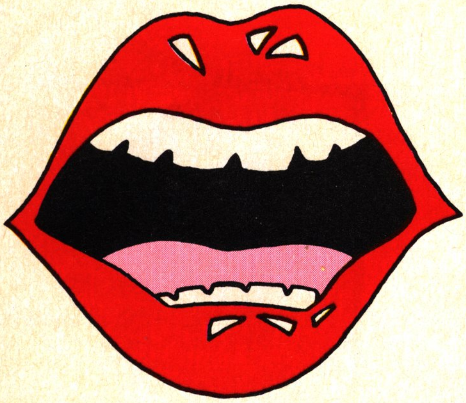
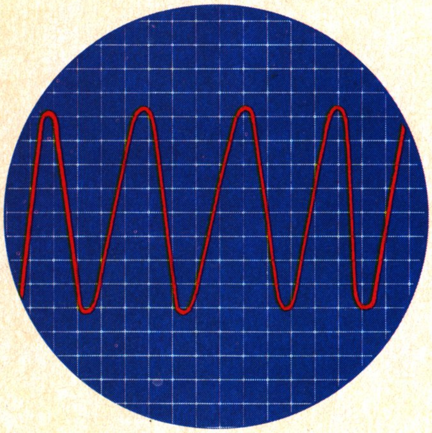
Analog-To-Digital And Back Again

By Jeremy Spiller





One of the most interesting aspects of the Color Computer is its ability to synthesize sounds, and perhaps the most interesting sound of all is the human voice. This very simple machine language program will digitalize your voice or any other sound that is input through the cassette recorder port, then store the data as a linear array of bits in memory. These bits can then be used to re-create the original sound.

All sounds are simply "vibrations" of the air, or more precisely, variations in air pressure. They amount to "peaks" of high pressure followed by "valleys" of low pressure. How closely the peaks are spaced (frequency), and how high the peaks are (amplitude) determine the nature of the sound.

A loudspeaker makes sounds by re-creating the same variations in air pressure as the voice or instrument that created them in the first place. The original sound is first translated to electrical voltage vibrations. The loudspeaker responds to higher voltages by pushing its diaphragm farther out, and to lower voltages by allowing the diaphragm to fall back inward again. As the diaphragm vibrates, it pushes on the surrounding air reproducing the original sound. Of course, these vibrations are extremely fast, but your CoCo is even faster.

The Color Computer is able to synthesize sounds because it can manipulate the voltage output to the loudspeaker about as quickly as the original sound produced its vibrations in the air. It does this by manipulating numbers with lightning speed, and those numbers are simply ones and zeros. The high pressure "peaks" can be thought of as ones, and the low pressure "valleys" correspond

---

(Jeremy Spiller is a 13-year-old student who has been an avid computer programmer since receiving a TRS-80 CoCo three years ago. He started assembly language programming about a year ago, and plans to start writing his own machine language games soon.)

to zeros. While this is an oversimplification of the physics of sound, it is still a fairly accurate assessment, and one can begin to see how a computer can create sounds from simple data.

With the right combination of ones and zeros, you can fabricate any sound you want to, including the sound of your own voice. But first, you must somehow change your voice into the correct series of ones and zeros. This process is called "digitalizing," and the program that does it is called an "analog-to-digital converter." It converts your voice, which is an analog (continuous) signal, into digital data by sampling it at regular intervals.

This data may then be stored in the computer's memory, and using a different program, it may then be retrieved and used to re-create the original sound. While BASIC may appear fast, it is not fast enough to sample the analog signal with any precision. On the other hand, the CoCo's 6809 microprocessor can move fast enough to do the job, but you must talk to it directly — through a machine language program.

A complete listing of the assembled program is provided. Note that it is composed of three separate programs strung together. The first program digitalizes the tape recorder input and stores the input in memory as a continuous string of bits. The second program retrieves these bits and outputs them to the television loudspeaker. The third program is actually executed first and allows the user to adjust the recorder volume for the best fidelity possible. By using this option you are assured of the clearest possible digital array of stored bits.

How to Use the Program

First, key in and run the basic driver. The data statements contain the assembled object code that comprises the ML program. (Note that each number corresponds to a two-digit Hex number in the second and third columns of the assembly.)

Next, prepare a tape for digitalizing by speaking in a normal voice into the microphone. Speak slowly, loudly and enunciate clearly. Next, be sure the correct jack is connected to the earphone plug of the recorder, and that the other end of the cord is connected to the cassette port on the back of the recorder.

Press '1' at the menu and press Play on the recorder. Turn up the volume on your TV. The sound you hear is being processed in a way similar to the way it will be processed during digitalization and playback. Adjust the volume on your recorder so your words are as clear as they can be, and the space between them as dead as possible. In order to break out of this mode, you must press the Reset button. You will have to rerun the basic driver once you break out of the volume check mode.

Now you are ready to digitalize your voice. Prepare the tape so it is at the exact beginning of the sounds you wish to store in memory. Only the first 13 or so seconds of input will be stored, so be sure your tape is within one or two seconds of the signal you prepared earlier. Press the Play button on the recorder. If the remote pause jack is in place, the motor will not start until you are ready to begin. Press '2' and ENTER at the menu. Press ENTER again and the digitalizing routine will begin. The motor starts and stops automatically. When the analog to digital program is finished, the basic driver tells you so.

> ***"With the right combination of ones and zeros, you can fabricate any sound you want to, including the sound of your own voice."***

Now, to reassemble the data into sound, press '3' at the menu. A prompt will request a delay number. The default value is six. By varying this number, you may vary the speed and pitch of the playback. You may play it back as many times as you wish by pressing '3' again and again.

The quality of the data is affected by the volume of the recorder during the digitalization segment, so you may be able to improve on the quality of the sound by going back and redatalizing at a different volume.

How the Program Works

If you wish to understand the workings of the program, please consult the assembly listing. While the purpose of this article is not to teach assembly language programming, I will try to give a reasonable explanation of how the data is input into the machine, how it is stored in memory, and how it is then utilized to reproduce the sound. In order to understand computer sound synthesis, you first must understand the mysteries of magic memory-location FF20.

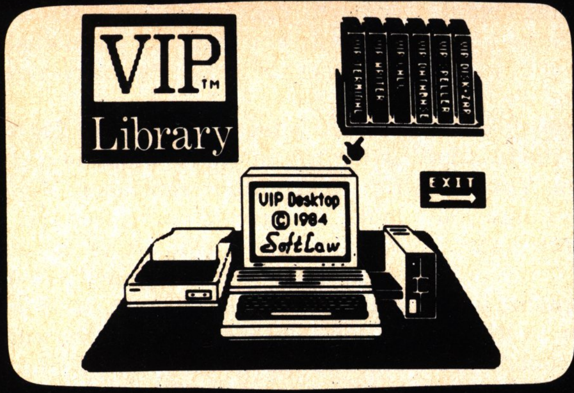
FF20 is located in the last 256 bytes at the top of ROM which is reserved for input/output functions. While it looks to the microprocessor like any other memory byte, it is in reality "superbyte." While disguised as a mild-mannered ordinary byte, it is really responsible for communication with the cassette port, the printer and the loudspeaker of our TV. (And that's only while the computer is operating. Who knows what it does at night while we're asleep!)

FF20 has eight bits (numbered '0' to '7') like any other byte. Bit zero, located farthest to the right, is solely responsible for all input and output to and from the cassette port. Its main function is to send and receive binary information to and from the computer from cassette tape. It was designed for use with signals that are already digitalized (i.e., tape saves of programs), however, it does respond to any other noises that come through the cassette port, including voices.

If the volume on the cassette recorder is correct, it produces a reasonable representation of most sounds in ones and zeros. The analog-to-digital converter collects the ones and zeros and stores them, one by one, in memory. It begins by defining the first memory location designated for storage of data as &H2500 in Line 110.

Line 120 resets all bits in FF20 to zeros. Line 130 sets the count to eight, the number of bits in each byte. Lines 150 to 170 are simply a timing loop. They make the computer count to six between bits. Location &H790B contains the number six. By poking other numbers into this location, you can get the computer to wait for a longer or shorter time between storing bits. Changing this number changes both the length of tape digitalized and the quality of the sound in the reproduction.

Remember that while all this is going on, bit zero is changing back and forth between zeros and ones in response to the input from the tape recorder. Lines 172 and 174 are the real "meat" in this program — 172 does an LSR (Logical Shift Right) of Location FF20. This shifts all the bits in FF20 one place to the right. In other words, bit seven is moved over into the position of bit six, bit six is moved over to the position



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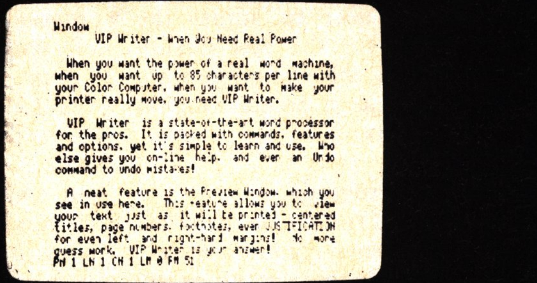

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else gives you  on-line  help,  and  even  an  Undo
command to undo mistakes!

  A  neat  feature is the Preview Window, which you
see in use here.   This feature allows you to  view
your  text  just  as  it will be printed - centered
titles, page numbers, footnotes, even JUSTIFICATION
for even left  and  right-hand  margins!  No  more
guess work.  VIP Writer is your answer!
PN 1 LN 1 CN 1 LM 0 FM 51
```

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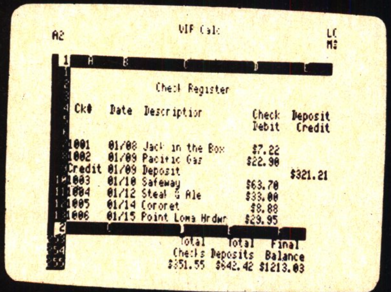

```
A2                     VIP Calc                        LC
                                                       MS
 1   A     B           C              D        E
 1
 2
                   Check Register

     Ck#    Date  Description         Check   Deposit
                                      Debit    Credit

     1001   01/08 Jack in the Box     $7.22
     1002   01/09 Pacific Gas        $22.90
     Credit 01/09 Deposit                      $321.21
     1003   01/10 Safeway            $63.70
     1004   01/12 Steak & Ale        $33.00
     1005   01/14 Coronet             $8.88
     1006   01/15 Point Loma Hrdwr   $29.95
 2            C              D         E
                          Total     Total     Final
                         Checks  Deposits   Balance
                        $351.55   $642.42  $1213.03
```

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Technologies

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of bit five and so on, right down to bit zero, which appears to fall off the right end into oblivion.

Actually, this bit is saved in a special location called "the carry" which is one bit in a special register called the "condition codes." This is most fortunate because bit zero, now saved in the carry, contains the information we are interested in storing in memory.

Now that we have the bit stored in the carry, we want to store it some place in memory. Line 174 does this with an ROLA. A register is a memory location within the microprocessor itself used for the temporary storage of numbers. The 'A' register is an eight-bit register, just like any memory location. "ROLA" means Rotate the 'A' register one bit to the left. This is something like a Logical Shift Left, except that all bits are shifted to the left, the leftmost bit (bit seven) goes into the carry, and the bit that was in the carry before now becomes the new bit zero in the 'A' register.

If this process were repeated continuously, you would see the bits marching to the left, circling around through the carry and back again into register 'A' from right to left. A single cycle of this has now put the contents of the carry into the 'A' register in the position of bit zero.

This process will be repeated a total of eight times, each repetition shifting the important bit zero out of FF20 into the carry, and then rotating it into register 'A.' Each rotation carries the previously rotated bits in register 'A' one more place to the left until the first one rotated in now occupies the position of bit seven.

Line 190 subtracts one from the "8 count" (remember Line 130), and Line 200 sends the microprocessor back to Line 150 for another rotation if it has not filled the 'A' register with eight bits of data from FF20. If Register 'A' is now full of the input data, Line 210 then stores it in the memory location &H2500 (The 'X' register still is "pointing to" &H2500 from Line 110), then increments the pointer by one (the 'X' register now holds the number &H2501).

The entire cycle is repeated until all memory locations from &H2500 to &H7900 are filled with data. Line 220 checks to see if the data has reached the top of RAM. If it has not, Line 230 sends the microprocessor back to Line 130, otherwise Line 240 returns control to BASIC.

Lines 280 to 480 work in a similar way to retrieve the stored data. In order to hook FF20 to the TV loudspeaker, a few other "adjustments" must be made in other ROM locations. These adjustments are made in a subroutine named "sound" and that subroutine is called in Line 280. The microprocessor then follows the instructions in lines 600 to 680 and then returns to Line 365.

The mechanics of the sound routine are not important to an understanding of this program. What *is* important is an understanding of how FF20 controls the output voltage to the loudspeaker. Once enabled by the sound routine, the six most significant (i.e., leftmost) bits in FF20 are now available to hold binary numbers from zero to 63. Each number represents a voltage between zero (represented by zeros in all six bits) and -5 volts (represented by ones in all six bits [63 decimal]).

Any number stored in these six bits is immediately translated into a voltage at the loudspeaker. The trick is now to get the bits out of memory and into the left end of FF20. This is accomplished by once again loading the pointer with the location of the first byte in memory (Line 365) and loading register 'A' with the contents of $H2500 (Line 370).

(Note that the pointer is incremented at this point instead of later on as was the case in the digitalizing program.)

Line 380 again sets the count to eight. This time, however, the 'A' register is shifted left instead of to the right. This pushes the most significant bit into the carry. Line 400 now rotates FF20 to the right which pushes our data bit from the carry into position seven in FF20. This causes an immediate change in the voltage output to the loudspeaker. Again, the process is carried out eight times until all eight bits from memory have been rotated into FF20.

Line 470 now sends us back to Line 370 where register 'A' picks up the next byte and rotates that into FF20, and so on until all the data to the top of RAM is used up.

The Volume Check Routine is easy to understand. It also makes use of the sound enable subroutine and then simply rotates bit zero of FF20 through the carry and into bit seven which controls the loudspeaker.

Playing with the Binary Program

Once you have loaded the machine language program in high RAM, you can discard the BASIC program that poked it in by typing NEW and then fabricate your own programs that manipulate the timing loops or change the origin of the data array.

Remember that &H790B contains a six, but that you can speed up or slow down the program by poking different numbers here. Smaller numbers will give a higher quality sound, but a shorter real-time recording. The playback segment also has a timing loop, and location &H792F also contains a six. The basic driver has a provision to manipulate this number, but you can do the same thing by poking any number into &H792F.

Since the machine language programs can stand alone, it is possible to include them as a "talking subroutine" in your BASIC programs. Patch 1, or the digitalizing routine, is a complete program and will stand alone without Patch 2 or Patch 3. Patch 2 is the playback routine; it requires that Patch 3, which includes the sound enable subroutine, be included with it.

These programs are not relocatable, but if you want to use the playback routine alone without the A/D converter, you can do it as long as you remember to poke Patch 2 beginning at &H791F, followed by Patch 3 ending at &H795C. Remember to protect these routines along with your digitalized data with `CLEAR 200,&H****`. The asterisks, of course, stand for a number. This number should be one lower than the first byte used to store your digital data. To set this address, consult the summary of key pokes.

Summary of POKEs and EXEC Addresses

&H7900 — EXEC address of A/D converter
&H791F — EXEC address of playback segment
&H793D — EXEC address of volume check routine
&H7901:&H7902 and
&H7922:&H7923 — Contain the address of first byte of data array
&H790B — A/D converter timing loop. Default=6
&H792F — Playback timing loop. Default=6

(Anyone having questions about these programs may contact Jeremy at RFD #1, Shirley, MA 01464, phone (617) 448-2681.)

Listing 1: A/D DRVR

```
130 ......224
END ......12
```

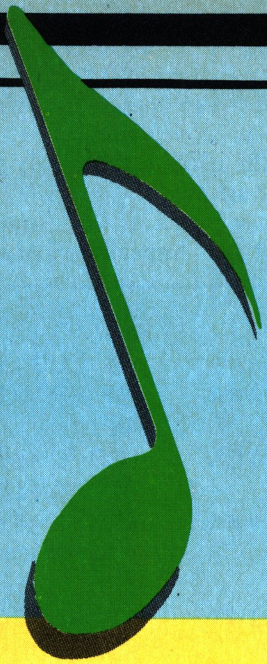
```
0 CLS:PMODE0:GOTO 350
10 CLEAR200,&H24FF
15 'PATCH 1
20 DATA 8E,25,00,7F,FF,20,C6,08,
10,8E,00,06,31,3F,26,FC,74,FF,20
,49,5A,26,F1,A7,80,8C,79,00,25,E
8,39
25 'PATCH 2
30 DATA 8D,23,8E,25,00,A6,80,C6,
08,48,76,FF,20,10,8E,00,04,31,3F
,26,FC,5A,26,F1,8C,79,00,25,E8,3
9
35 'PATCH 3
40 DATA 8D,05,76,FF,20,20,FB,B6,
FF,01,84,F7,B7,FF,01,B6,FF,03,84
,F7,B7,FF,03,B6,FF,23,8A,08,B7,F
F,23,39
50 FOR X=&H7900 TO &H791E:READ A
$:A=VAL("&H"+A$):P1=P1+A:POKE X,
A:NEXT
60 FOR X=&H791F TO &H793C:READ A
$:A=VAL("&H"+A$):P2=P2+A:POKE X,
A:NEXT
70 FOR X=&H793D TO &H795C:READ A
$:A=VAL("&H"+A$):P3=P3+A:POKE X,
A:NEXT
80 IF P1<>3092THENPRINT"ERROR IN
 PATCH 1":E=1
90 IF P2<>2852THENPRINT"ERROR IN
 PATCH 2":E=1
100 IF P3<>4498THENPRINT"ERROR I
N PATCH 3":E=1
110 IF E=1 THEN STOP
120 CLS
130 PRINT"  ANALOG TO DIGITAL CO
NVERTER"
140 PRINT"       BY JEREMY SPILLE
R"
150 PRINT
160 PRINT"1. TEST VOLUME OF TAPE
 RECORDER"
170 PRINT"2. READ TAPE (DIGITALI
ZE)"
180 PRINT"3. SAY DATA (PLAYBACK)
"
190 PRINT
200 INPUT" PICK A NUMBER";A
210 ON A GOTO 230,280,310
220 GOTO 120
230 CLS
240 PRINT"TO GET BACK TO MENU PR
ESS RESET THEN RUN THIS PROGRAM.
"
250 PRINT
260 PRINT"SET YOUR TAPE RECORDER
 TO THE   CORRECT VOLUME"
270 MOTORON:EXEC &H793D
280 CLS:INPUT"ENTER TO RECORD";A
:MOTORON:CLS
290 PRINT"READING TAPE":EXEC &H7
900:MOTOROFF
300 GOTO 120
310 CLS:INPUT"TYPE A NUMBER 1-15
 TO CONTROL    THE SPEED.  ENTER
 OR 6 = DE-   FAULT";S:IF S=0 TH
EN S=6
320 IF S>15 THEN 310
330 CLS:PRINT"SAYING":POKE &H792
F,S:EXEC &H791F
340 GOTO 120
350 PCLEAR1:GOTO10
```

Listing 2: A/D PRGM

```
                    00010 *************************
                    00020 *  SIMPLE A/D CONVERTER *
                    00030 *   BY JEREMY SPILLER   *
                    00040 *        1985           *
                    00050 *************************
7900                00100         ORG     $7900
7900 8E   2500      00110 START   LDX     #$2500
7903 7F   FF20      00120         CLR     $FF20
7906 C6   08        00130 ST010   LDB     #$8
7908 108E 0006      00150 TIME    LDY     #6
790C 31   3F        00160 TIME2   LEAY    -1,Y
790E 26   FC        00170         BNE     TIME2
7910 74   FF20      00172         LSR     $FF20
7913 49             00174         ROLA
7914 5A             00190         DECB
7915 26   F1        00200         BNE     TIME
7917 A7   80        00210         STA     ,X+
7919 8C   7900      00220         CMPX    #$7900
791C 25   E8        00230         BLO     ST010
791E 39             00240         RTS
                    00250 *************************
                    00260 *  RECONSTRUCTS SOUNDS  *
                    00270 *************************
791F 8D   23        00280         BSR     SOUND
7921 8E   2500      00365         LDX     #$2500
7924 A6   80        00370 SOUND1  LDA     ,X+
7926 C6   08        00380         LDB     #8
7928 48             00390 SOUND2  LSLA
7929 76   FF20      00400         ROR     $FF20
792C 108E 0006      00410 TIMER   LDY     #6
7930 31   3F        00420 TIMER2  LEAY    -1,Y
7932 26   FC        00430         BNE     TIMER2
7934 5A             00440         DECB
7935 26   F1        00450         BNE     SOUND2
7937 8C   7900      00460         CMPX    #$7900
793A 25   E8        00470         BLO     SOUND1
793C 39             00480         RTS
                    00490 *************************
                    00500 *  VOLUME CHECK ROUTINE *
                    00510 *************************
793D 8D   05        00520         BSR     SOUND
793F 76   FF20      00530 VOLUME  ROR     $FF20
7942 20   FB        00540         BRA     VOLUME
7944 B6   FF01      00600 SOUND   LDA     $FF01
7947 84   F7        00610         ANDA    #$F7
7949 B7   FF01      00620         STA     $FF01
794C B6   FF03      00630         LDA     $FF03
794F 84   F7        00640         ANDA    #$F7
7951 B7   FF03      00650         STA     $FF03
7954 B6   FF23      00660         LDA     $FF23
7957 8A   08        00670         ORA     #8
7959 B7   FF23      00680         STA     $FF23
795C 39             00690         RTS
          0000      00700         END
00000 TOTAL ERRORS
```

Simplifying Use of the SOUND Command

By William R. White



Do you love computer music, but hate entering long command lines? Frustrated because you can't use your hard-learned music lessons? Still using your 4K or non-extended machine?

If so, cheer up fellow programmers, this article is for you! If adding music to enliven a program appeals to you, read on.

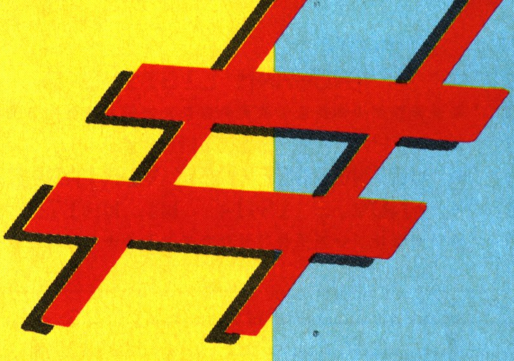
When you first got your CoCo and excitedly began *Getting Started With Color BASIC*, one of the first places you probably "stalled" was the SOUND chapter. Admit it! We all did. Creating sounds (music, if you prefer) is fun! But soon the drudgery of SOUND, "tone" and "duration" wore out the fingers and the SOUND command was put on the back shelf.

Listing 1 is the BASIC program for "Happy Birthday." It contains the traditional SOUND commands. Listing 1 works very well, if you don't mind entering individual command lines and constantly referring to the musical tones appendix. However, I suspect that none of us wants the extra effort of repeatedly turning to a reference page.

Let's put some of the RAM memory power to work! Listing 2 contains the same program, this time with the tone values given as simple numeric variables and neatly tucked away in memory. Once they have been defined (lines 100-110) the tone value can be called by use of its label (a letter). Time values are stored (Line 120) and called to use by their proper label (letter). Using this method, the note lengths in the entire song can be quickly changed by reassigning values of time variables. Try *that* with your PLAY command!

Once these numeric variables have been defined, a valid command line is "SOUND letter, letter" (i.e., SOUND C,Z). You have already saved keystrokes, your memory and there are no numbers to remember! Now you are free to concentrate on the music, not on a reference page.

Another method of accomplishing the same end is shown in Listing 3. DATA statements are composed of note values followed by the time value. When this information has been written into DATA, it is read in the same sequence and executed by one (that's right, just one) SOUND statement. Again our efforts are



(William White has taught junior high school science for 20 years. His hobbies include amateur radio, photography and "CoCo-ing." This is his first year of teaching computer literacy and his first published article.)

conserved by using the power and efforts of the mighty CoCo.

Entering either listing 1 or 2 requires the use of 25 SOUND statements. By using Listing 3, SOUND is entered just once and made to repeat by the FOR/NEXT loop. This saves keystrokes, memory and needless repetition.

Our objective at the outset was to simplify the use of the SOUND command. One method shown does this by defining tone numbers as variables. The other eliminates the need to repeatedly enter the SOUND statement.

For you who have worn out (or thrown out) the "Appendix of Musical Tones," the octave of Middle C is as follows: Middle C=89, D=108, E=125, F=133, F#=140, G=147, A=159, B=170, B♭=165 and Cl=176.

There you have it! Dust off the old music books, do your thing, call in the family and have a sing-a-long. After all, computers *are* fun!

Listing 1: BRTHDAY1

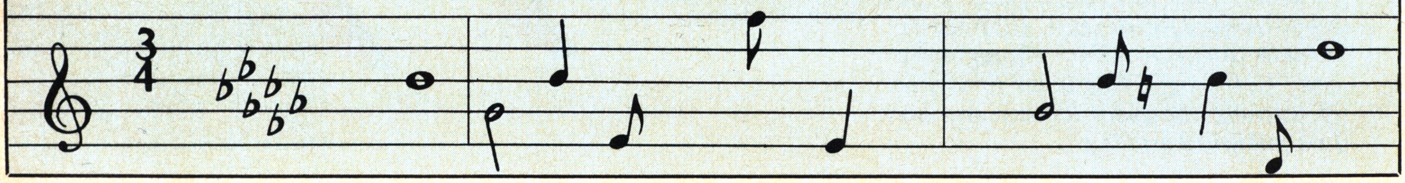
```
10 '       PROGRAM LISTING 1
20 '*****************************
30 '*    'HAPPY BIRTHDAY
40 '* USING SOUND TONE, DURATION
50 '* NOV., 1984  W. WHITE
60 '*****************************
70 '
80 CLS
90 PRINT"      PLAYING HAPPY BIRT
HDAY"
100 SOUND 89,4
110 SOUND 89,4
120 SOUND 108,8
130 SOUND 89,8
140 SOUND 133,8
150 SOUND 125,16
160 SOUND 89,4
170 SOUND 89,4
180 SOUND 108,8
190 SOUND 89,8
200 SOUND 147,8
210 SOUND 133,16
220 SOUND 89,4
230 SOUND 89,4
240 SOUND 176,8
250 SOUND 159,8
260 SOUND 133,8
270 SOUND 125,8
280 SOUND 108,8
290 SOUND 165,4
300 SOUND 165,4
310 SOUND 159,8
320 SOUND 133,8
330 SOUND 147,8
340 SOUND 133,8
350 END
```

Listing 2: BRTHDAY2

```
10 '       PROGRAM LISTING 2
20 '***************************
30 '*  'HAPPY BIRTHDAY'
40 '* USING DEFINED VARIABLES
50 '*  NOV., 1984  W. WHITE
60 '****************************
70 '
80 CLS (3)
90 PRINT"   PLAYING HAPPY BIRTHD
AY"
100 C=89:D=108:E=125:F=133:G=147
110 A=159:B=170: B1=165: C1=176
120 X=4: Y=8: Z=16
130 SOUND C,X : SOUND C,X : SOUN
D D,Y : SOUND C,Y : SOUND F,Y :
SOUND E,Z
140 SOUND C,X : SOUND C,X : SOUN
D D,Y : SOUND C,Y : SOUND G,Y :
SOUND F,Z
150 SOUND C,X : SOUND C,X : SOUN
D C1,Y : SOUND A,Y : SOUND F,Y :
 SOUND E,Y : SOUND D,Y : SOUND B
1,X : SOUND B1,X
160 SOUND A,Y : SOUND F,Y : SOUN
D G,Y : SOUND F,Y
170 END
```

Listing 3: BRTHDAY3

```
10 ' PROGRAM LISTING 3
20 '*************************
30 '*      'HAPPY BIRTHDAY'
40 '* PLAY USING DATA STATEMENTS
50 '*  NOV., 1984  W. WHITE
60 '**************************
70 '
80 CLS (3)
90 PRINT"   PLAYING HAPPY BIRTHD
AY"
100 DATA 89,4,89,4,108,8,89,8,13
3,8,125,16
110 DATA 89,4,89,4,108,8,89,8,14
7,8,133,16
120 DATA 89,4,89,4,176,8,159,8,1
33,8,125,8,108,8
130 DATA 165,4,165,4,159,8,133,8
,147,8,133,8
140 FOR R=1 TO 25
150 READ S,T
160 SOUND S,T
170 NEXT
180 END
```



EDUCATION NOTES

4K

A Serendipitous Learning Experience

By Steve Blyn
Rainbow Contributing Editor

Sometimes it is important to present students with an educational program that is mostly for fun. Entertainment remains one of the primary reasons many of us bought computers in the first place. This month's program attempts to combine learning with fun.

Although it is loosely intended as a language arts program, there is really no definite learning that is expected from this program. Many incidental learnings, however, may occur that we are not always aware of at the moment.

Incidental learning is learning that is not necessarily designed to happen, but rather occurs as a side effect of the experience. Typing in computer programs from magazines, for example, often produces the incidental learning of the keyboard. Another example might be shopping with your family in a department store. This may produce incidental learning about using money, travel training, reading signs and a host of others.

(Steve Blyn teaches both exceptional and gifted children, holds two master's degrees and has won awards for the design of programs to aid the handicapped. He and his wife, Cheryl, own Computer Island.)

The game we are doing this month is a code breaker. The alphabet is written on the screen with a number next to each letter. Next to the letter 'A' is a '1,' next to 'B' is a '2,' and so on down to the letter 'Z' with a "26" next to it. This represents a simple code. Each letter may be associated with a different number. The numbers, of course, range from 1 to 26 to represent each of the letters.

A word should be entered by someone other than the player; this is a good two-player game. The computer will show the child the word in code and the child's job is to decode the secret word. For example, if someone types in the word `COCO`, the program will convert it into "3 - 15 - 3 - 15." The player must use the chart or his/her memory of the alphabetical order to decode the word back again to its original form.

This game may be played on two levels. You may either choose to have the code visible or invisible while you are decoding. If you choose to hide the code, you will have to review the alphabetical order mentally several times to figure out the word. This is much more difficult, of course, than leaving the code in view.

Younger players will most probably need the code visible at all times. Older players will no doubt hide the code each round. Middle-of-the-road learners will probably combine the two and benefit the most from this program; they can constantly be learning and reviewing the alphabetical order while playing the game.

Lines 400-430 draw the code. Line 450 will hide the code if that option is selected. Lines 120-140 present the option of hiding the code.

An easy possibility for altering this program is to present the letters and numbers in reverse order. The letter 'A' could be equivalent to 26, 'B' to 25, and so on to 'Z' equal to one. This would make the code slightly more difficult and the program more challenging. Two lines must be altered to accomplish this switch.

First, change Line 250 from

```
PRINT ASC(L$)-64;
```

to

```
PRINT ASC(L$)-91;
```

Secondly, change the portion of Line 410 which reads

```
A$(R)
```

to

```
A$(27-R)
```

These two changes will reverse the

position of the numbers. You may get more daring and devise your own schemes to further mix up the numbers, if you desire.

The partner types in the letters of the mystery word on lines 160-210. The computer converts these letters into numbers on lines 220-270. The player then guesses the secret word. If incorrect, the right answer will be displayed by Line 320.

We meant no pressure to be on the student in this program. For this reason, we included no time limit or report card. The game can be ended after each round by pressing 'E' or continued with more examples by pressing 'M.' The game can be played as long as the interest remains. We hope your children have fun as well as incidentally learn at the same time.

220 153
END 72

The listing: CODEWRDS

```
10 REM"SECRET CODE WORDS"
20 REM"STEVE BLYN,COMPUTER ISLAN
D,NY,1985"
30 DIM N(26),A$(26)
40 CLS
50 C$=""
60 PRINT@10,"SECRET CODES"
70 PRINT@32,STRING$(32,191);
80 FOR A=1TO 26: N(A)=A:NEXTA
90 FORB=1TO 26:A$(B)=CHR$(64+B):
NEXT B
100 GOSUB 390
110 SOUND 200,3
120 PRINT@64," DO YOU WANT TO HI
DE THE CODE?"
130 EN$=INKEY$
140 IF EN$="Y" THEN GOSUB 450 EL
SE IF EN$="N" THEN 150 ELSE 130
150 SOUND 220,3
160 PRINT@64," TYPE IN YOUR MYST
ERY WORD NOW."
170 B$=INKEY$
180 IF B$=CHR$(13) THEN 220
190 C$=C$+B$
200 IF B$="" THEN 170
210 GOTO 170
220 REM"PRINT OUT THE WORD USING
 NUMBERS"
230 FOR T=1 TO LEN(C$)
240 L$=MID$(C$,T,1)
250 PRINT ASC(L$)-64;
260 PRINTCHR$(8);:PRINT"-";
270 NEXT T
280 PRINT:PRINT" WHAT DO YOU THI
NK THE WORD IS      ";
290 INPUT M$
300 PRINTSTRING$(32,".");
310 IF M$=C$ THEN PRINT"
   CORRECT":SOUND180,5
320 IF M$<>C$ THEN PRINT"SORRY,T
HE ANSWER IS ";C$:SOUND10,3
330 PRINTSTRING$(32,".");
340 PRINT"PRESS 'M' FOR MORE OR
'E' TO END";
350 EN$=INKEY$
360 IF EN$="E" THEN CLS:END
370 IF EN$="M" THEN 40
380 GOTO 350
390 PRINT@321,STRING$(30,236);
400 REM"PRINT THE CODE"
410 FOR R=1 TO 26:PRINTN(R);CHR$
(8);"=";A$(R);:NEXT R
420 PRINT@481,STRING$(30,227);
430 RETURN
440 REM"HIDE THE CODE"
450 PRINT@352,STRING$(128,143);:
RETURN
```

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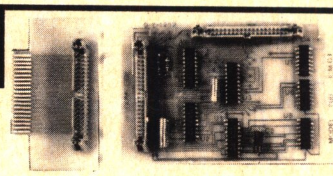
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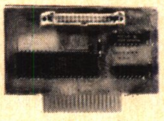
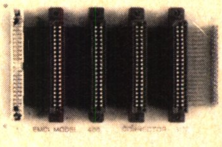

MODEL 100

MODEL 500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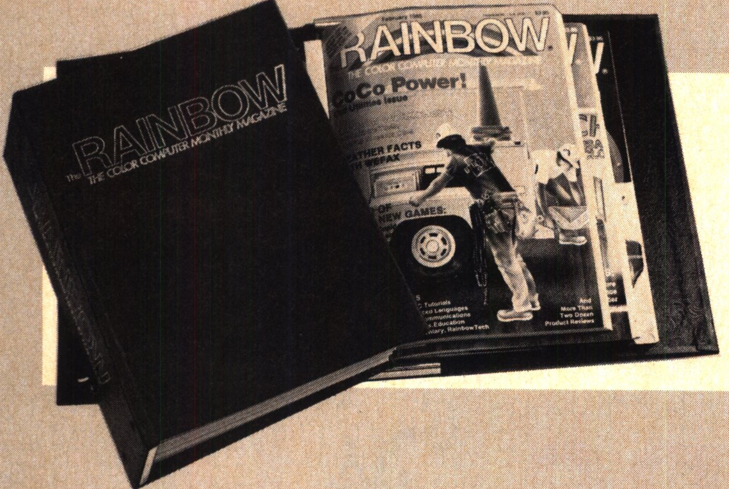

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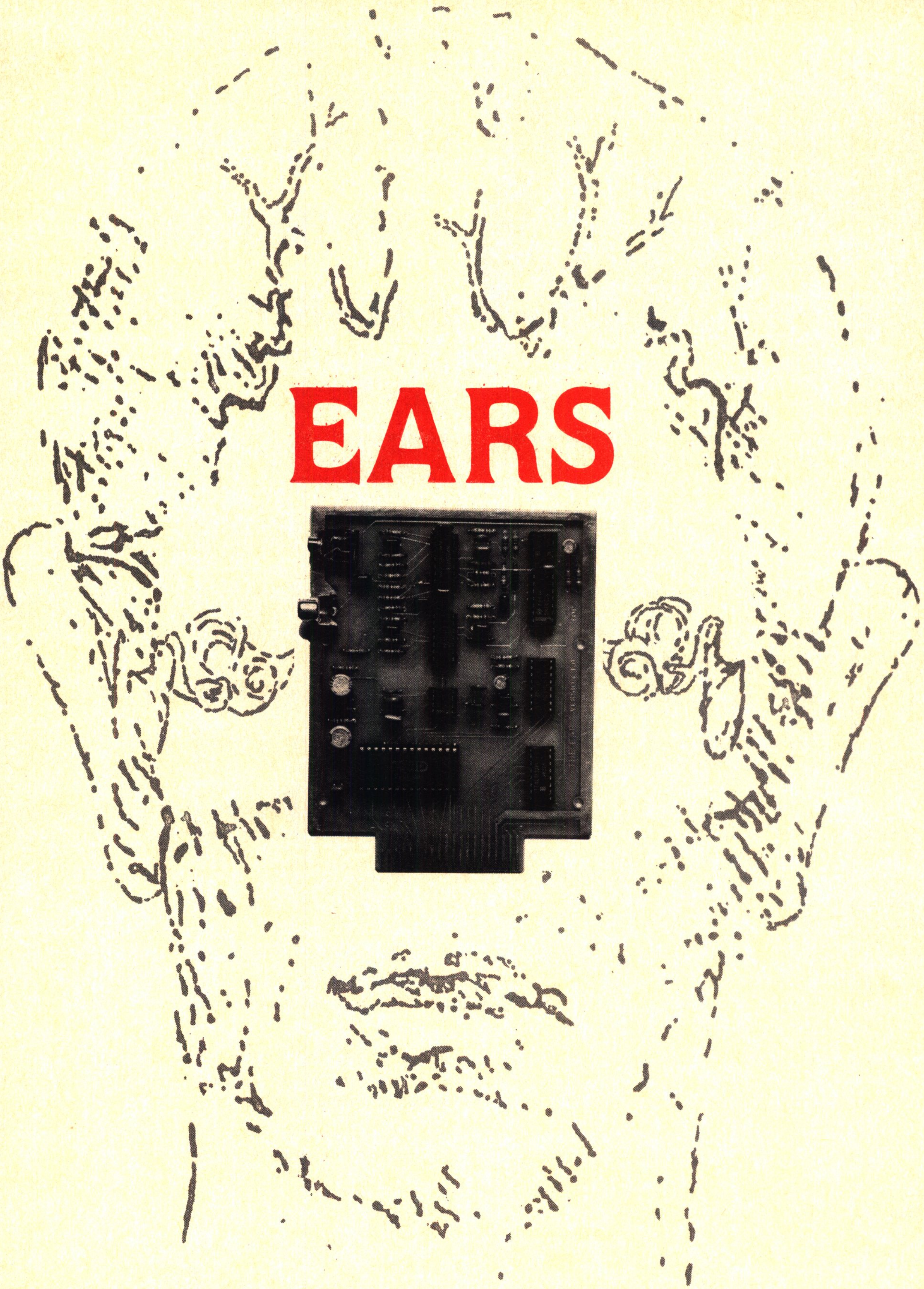
EARS



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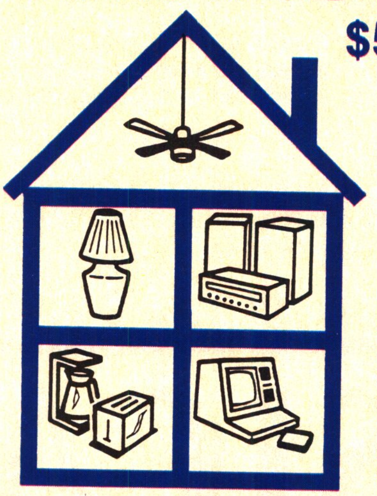

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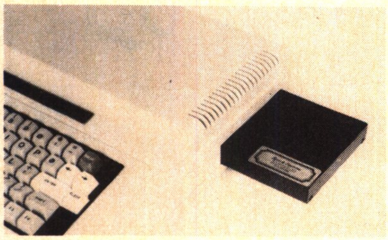

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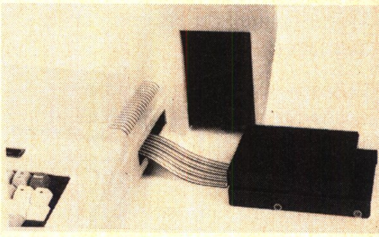

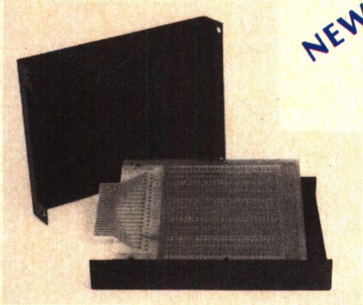

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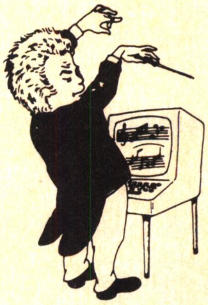

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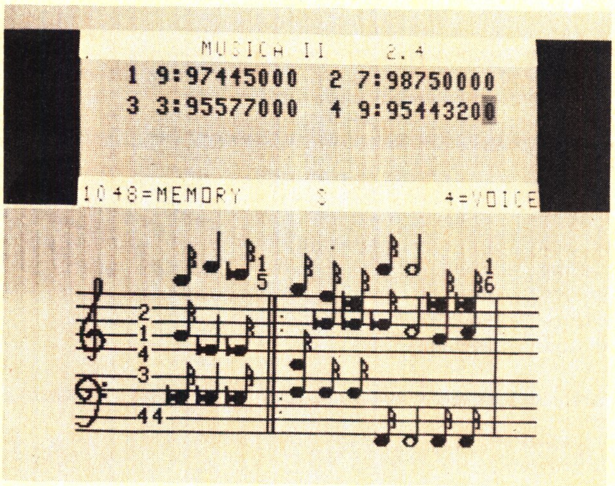
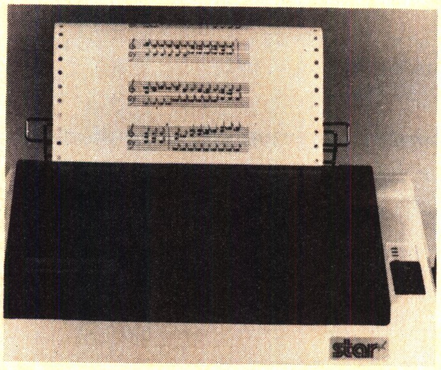


```
MUSICA II      2.4
 1 9:97445000   2 7:98750000
 3 3:95577000   4 9:95443200
1048=MEMORY      S       4=VOICE
```

- Repeat bars allow repeating of music without re-inserting music a second or third time.



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New Trends In Educational Computing

By Michael Plog, Ph.D.
Rainbow Contributing Editor

Back in April 1982, the Tandy Corporation began a program called "Tandy Educational Grants." The company provides sums of money to educational institutions for research and development of educational uses of computers. Since its beginning, the Tandy Educational Grants program has awarded over $885,000 worth of hardware and software.

The current "cycle" of awards was made for proposals based on "Using Microcomputers to Develop Thinking Skills." Tandy, of course, has several models of computers in its product line. Four awards were given during the current cycle; one involved the Color Computer.

This award went to Mrs. Margaret Perry of Safety Harbor Middle School, Safety Harbor, Fla. Her project is to establish a model program using computers to aid gifted students in improving their thinking and creative skills. Mrs. Perry (and the Safety Harbor school system) received 11 64K Color Computers with monitors and disk drives, a DMP-110 printer, color graphics printer, touch pad and several software packages. (Does that sound like a dream come true?)

At present, we do not know exactly how the hardware and software will be used, or what the curriculum will look like. In the future, we hope to be able to report on the results of this project. The materials and procedures developed in Safety Harbor might be worthwhile to adapt to your local school system.

Possibly, curriculum materials may be developed that you can use at home. Whatever the outcome of the Safety Harbor experience, you should be aware that the Tandy Corporation is taking education seriously, and even providing funds for innovative programs in schools.

If you are interested in preparing a proposal of your own, write to Tandy Educational Grants Program, Radio Shack Education Division, 1400 One Tandy Center, Forth Worth, TX 76102. The educational community needs to experiment with different uses of computers, and we need quality products and procedures to use in schools. Since schools are often short of money, outside sources of funds are important to continue development of curriculum to benefit all students in the country.

Even with the reduction of funds for education from the federal government, there are still some programs which help development of educational experiences. The National Diffusion Network is one such program. This program provides funds for innovative programs, then goes the next step. Funds are also provided to help school systems implement the projects that have been judged successful. Several Diffusion projects in past years have dealt with computers in the classroom.

One of the most recent such projects is the Asbury Park Computer Math Program. The goal of this project is to integrate computers into the entire curriculum of grades 9-12, with 18 hours of instruction in each of six subject areas: general mathematics, algebra I and II, geometry, trigonometry and calculus. The emphasis of this project is on mathematics, but other projects have stressed different aspects of the educational arena. You can find out what National Diffusion Network

---

(Michael Plog received his Ph.D. degree from the University of Illinois. He has taught social studies in high school, worked in a central office of a school district, and currently is employed at the Illinois State Board of Education.)

projects exist by contacting the administration of your local school district.

Another sign of federal involvement in computers for schools is from the National Institute of Education (NIE). This organization has set as one of its priorities for 1986 an investigation into the effective uses of education software and technology. We hope NIE officials are aware of projects similar to the one in Safety Harbor. The report from NIE should be completed in 1986, but interim reports may be released earlier.

One study NIE will probably examine has been conducted by the Office of Bilingual Education and Minority Languages Affairs (of the Department of Education). The Office recently released a report on the use of educational technologies in programs dealing with limited English-proficient students. The study was limited to students with a native language other than English.

Computer assistance has long been thought to be helpful for such students, because some students may be in school districts where no one else (teacher, aide, principal) speaks the same language as the student. Computer assisted instruction could help such students learn English, as well as basic skills in their native language. The study conducted by the Office has several findings. Many of the findings apply to all students, not just those with limited English proficiency.

As might be expected, funding for computer assisted instruction increased from 1982 to 1984, while funding for audio-visual technologies decreased. This is not to imply that schools dealing with limited English proficient (LEP) students are no longer interested in audio-visual technology. Many schools have already purchased this type of equipment, and have no need for more equipment. In a few years, we will probably see less money spent for hardware and more resources used for software.

> ***"As the nation moves from an industrial to an information economy, schools must ensure that all children have access to computers."***

The study also found that educational technologies can increase the effectiveness of instruction for LEP students. In addition, the study concluded that computer assisted instruction holds a greater educational potential than other technologies, such as audio-visual techniques.

The study also pointed out some concerns for users of computers in the classroom. One finding relates to staff dealing with computer assisted instruction. A lack of planning and staff training have compromised the effectiveness of many CAI programs. As with any educational program, poor staff preparation and poor planning will result in a "hit or miss" outcome.

Positive results are due more to chance than conscious effort. And, many educational computer programs depend on one key person; without that person (the study founder), the project would most likely fail. Again, as with any program, a single individual has difficulty institutionalizing a set of educational experiences.

Two other findings are important from this study, and should be

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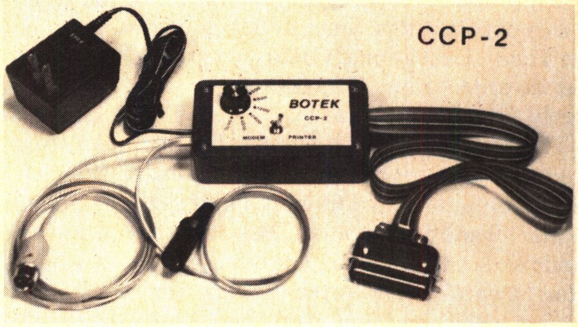

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recognized by anyone trying to implement computers in schools. The people initiating the computer assisted instruction program often had objectives that were not specific enough for success. We all know people who are so enamored with the equipment that they do not realize its use.

Finally, the study found what most educators have been saying: A lack of instructionally and technically sound software has reduced the effectiveness of CAI for limited English-proficient students. Naturally, the lack of good software is not limited to students with a native language other than English.

This study, while limited in scope and intent, is worthy of study by people interested in computer assisted instruction. While computer assisted instruction is only one component of computer use in schools, it is an important component.

The federal government may even take a more active role in computer education, if Representative Timothy Wirth, a Democrat from Colorado, gets his way. Congressman Wirth will introduce a computer literacy bill in the House of Representatives this year. The purpose of his bill is to help schools buy microcomputers, train teachers, establish a federal information bank and create a computer consulting service. The proposed legislation covers a broad area of assistance to educational computing.

Last year, Congressman Wirth introduced a similar bill, but it was not passed. He is trying again. Wirth is interested in equity of access. As the nation moves from an industrial to an information economy, Wirth claims, schools must ensure that all children — regardless of wealth — have access to computers.

The issue of equity of access of computers is a priority topic for many people. A coalition of Washington computer educators has established SLICE (Support for Leadership in Computer Education). This group is organizing in-service training for local computer instructors with emphasis on equity. This group is working without any government funds, but has a localized area of interest and effect.

Some efforts for computer literacy are state oriented. After this summer vacation, all schools in Texas will have to begin teaching seventh and eighth graders computer literacy according to standard, state-mandated curriculum. Other states are implementing computer literacy programs, but none that I know of has a state-mandated curriculum.

The column this month has been a collection of news items, notices of happenings and events. If you learn of an event that could benefit other people interested in educational computing, please pass it along to me and I will insert it in the column. Please mail notices to me at 829 Evergreen, Chatham, IL 62629.

Before ending the column for this month, there is one other piece of news it is my personal privilege to share with you. My wife and I were honored with the birth of a daughter. As this is being written, my baby girl is less than one week old. She even helped me write part of the article, lying in my lap, with little fingers reaching for the keyboard.

She does not have her own Color Computer yet, but that will just be a matter of time. She is beautiful, and I even forgave the nurse in the hospital, who thought I was the grandfather.

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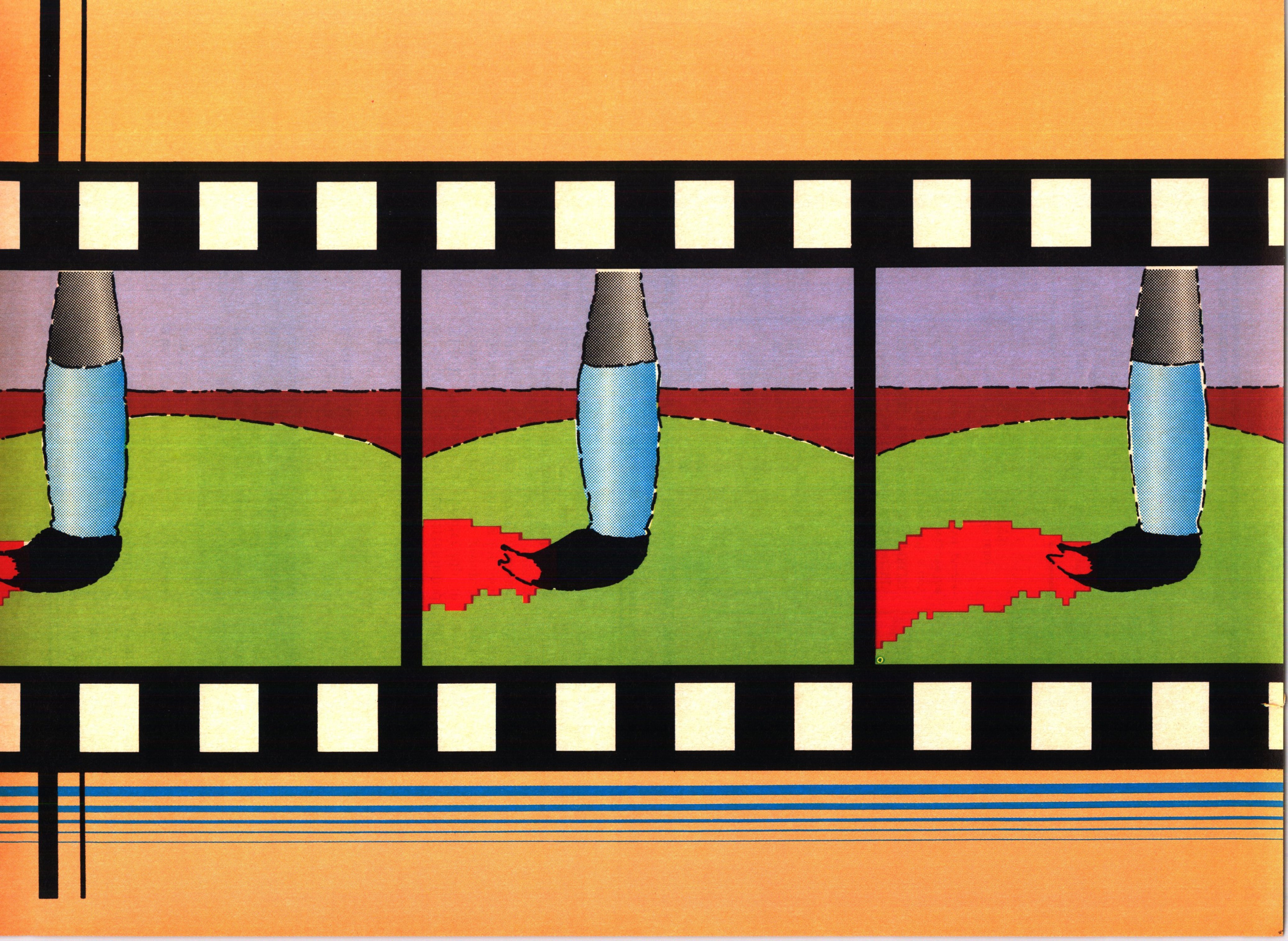


16K ECB

32K ECB

Ease the unwieldy task of writing animated graphics

Animatic:

Automatic Animation

By Rita Sabo

Automatic animation (*Animatic*) is a set of graphics animation subroutines that can be called from BASIC or Assembler. With *Animatic*, the cumbersome process of writing animated graphics is minimized. In addition, when written in Assembler, *Animatic* will provide smoother and faster animation.

Animatic takes advantage of the fact that most animation programs follow roughly the same logic (save previous screen contents, get object from old position, put object in new position, etc.) and it automatically performs many of these steps. .

To access *Animatic* from BASIC, you will make use of a "new" function called ANIM. The syntax for ANIM is:

```
X = ANIM(P0,P1, ...P7)
```

'X' is a numeric variable, and P0-P7 are the parameters described in Table I. The variable 'Y' will contain return codes and status information relevant to the selected function.

Depending on the selected function (value of P0), you may not need to specify all of the parameters. Zero is assumed when a parameter value is omitted: `Y = ANIM(P0,,P2)`, but if you omit coding double-commas, then the last used value for the missing parameter is used. Example: `Y = ANIM(P0,P1,,P3)` is the same as `Y = ANIM(P0,P1,0,P3)`, and `Y = ANIM(P0,P1)` will use the last used values for P2 . . . P7 (if applicable to the function indicated by P0).

(Rita Sabo holds a degree in literature. She enjoys reading the classics and working with the CoCo.)

To access *Animatic* from an Assembler program, you must first obtain the address of the Parameter Area by doing JSR INFO. There you should do a JSR ANIM with the proper parameters in this area. Upon exit, ANIM will set the 'D' register with the relevant operation status.

Description of Functions

Following find the description for each of the functions shown in Table I. For an example of a program using these functions, refer to program listings 1 and 2. Compare program Listing 1 with the "do-it-yourself #8-1" program of Radio Shack's *Going Ahead with Extended BASIC.*

DEFINE (P0=0)

It must be the first used ANIM function. It defines in P1 the maximum number of figures (a.k.a. objects) to be created in your program.

CREATE (P0=1)

A CREATE is required for each of the figures to be moved in your program. The figure will behave according to the values of P2 and P7.

You don't have to specify anything in P1. A sequential number (starting with 1) is assigned to each object as it is being created. Any further reference to this object will use this "object I D " instead of the traditional XY coordinates.

If P2 equals zero, the object will be placed on the screen exactly as it was created. If P2 is not zero, the object will be MIXed with the screen background. MIX is similar to the `OR` function for `PMODE`s 0, 2 and 4. See pictures 1 and 2 for a description of MIX effects in several `PMODE`s.

P3 and P4 indicate the XY coordinates of the object's upper-left corner. P5 and P6 indicate the width and height of the figure. P5 and P6 should not exceed 100.

P7 represents the action to be taken in the event that this object is moved to an XY position unfit for the size of the object. (For example: attempting to move an object 20 pixels wide to positions X=244, Y=14.) This condition will, from now on, be referred to as "overflow." With P7 = 0, *Animatic* will signal an error in overflow.

When P7 = 1, the object will be "frozen" on the nearest possible position on the border of the screen. In our example: X=235, Y=14.

If P7 = 2 the object would disappear in overflow. You can make it reappear by moving it to a legal position.

With P7 = 3, the object will "wrap-around," henceforth appearing on the extreme side of the screen (in our example: X=0, Y=14).

Regardless of the P7 selection, you will receive notice of overflows through the status of the operation.

MOVE (P0=2)

In P1, specify the number of the object to be moved. P2 represents the criteria for obtaining the new XY coordinates.

P2=0: The object will move to the absolute X-Y values specified in P3 and P4.

P2=1: The movement will be relative to the actual position. The P3 and P4 values will be added to the actual XY coordinates to obtain the destination. P3 and P4 can be negative.

P2=2: The object will move to the absolute XY coordinates pointed out by the left joystick. Because the joystick readings cover a 0-63 range, the 'X' reading is multiplied by four and the 'Y' reading by three.

P2=3: Same as in P2=2, but using the right joystick.

P3=4: The object has a relative movement with the displacements calculated from the left joystick readings.

The 'X' and 'Y' coordinates are calculated as follows:

```
X=X0+((XJ-32)*P3)/8
Y=Y0+((YJ-32)*P4)/8
```

Where XO and YO = actual coordinates.

XJ and YJ = X-Y joystick readings.

P3 and P4 = Values given for parameters 3 and 4. These values can be negative. However, the ANIM instruction will only accept negative values in Hex form, i.e., specify &HFF instead of -1.

Using this option, you can move the object with the direction and acceleration represented by the position of the joystick (i.e., P3 = 3 will give the effect of greater accelerations than P3 = 2).

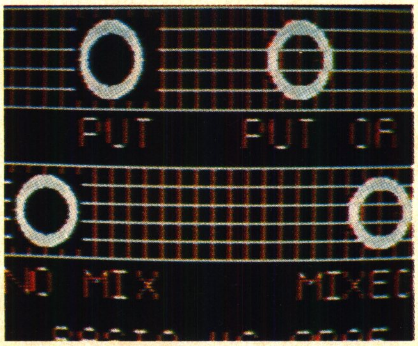
P2=5: Same as in P2=4, but using the right joystick.

P2=6: *Animatic* will select XY values at random. P3 and P4 represent the maximum random value for 'X' and 'Y.' P5 and P6 will be added to the generated 'X' and 'Y' values, respectively.

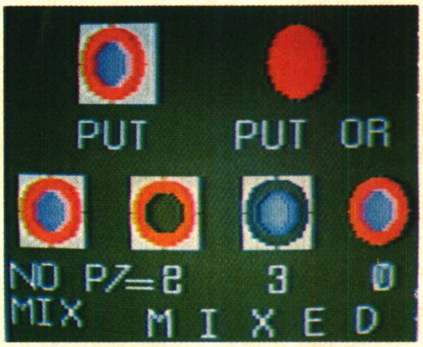
If you specify P3 and P4 = 0, *Animatic* will use P3=255; P4=191; P5=0; P6=0 as a default.

The random sequence has a period of 256, but *Animatic* reseeds itself once the period is exhausted by taking the timer value as a seed number. If you are calling *Animatic* from ML, write an interrupt routine to modify storage addresses $112-$113 accordingly.

P3=7: Keyboard controlled movement can be obtained by selecting this option.



Picture 1: MIX option in `PMODE`s 0, 2 and 4. Top using `PUT` (with and without `OR`). Bottom using *Animatic*.



Picture 2: MIX option in `PMODE`s 1 and 3. Top using `PUT`. Bottom using *Animatic* with several MIX color combinations.

The left/right arrows will generate a relative movement from the value in P4 and the up/down arrows from P5. The values in P4 and P5 should be positive since *Animatic* already knows the left/up arrows represent a negative displacement.

P2>7: Selecting P2 with a value greater than seven will redisplay the object in the current X-Y location.

P3-P6 as discussed above have different meanings depending on the value of P2.

P7 is used only if the object was CREATEd with MIX. P7 indicates the color to be omitted when the object is being mixed with the screen. P7=0 removes buff/green, P7=1 removes cyan/yellow, P7=2 magenta/blue, and P7=3 orange/red. Refer to Picture 2 for results with different P7 values.

As a result of the MOVE function, the variable at the left of the ANIM instruction will be set as follows:

0 = No screen overflow
1 = Upper screen overflow
2 = Bottom screen overflow
4 = Left overflow
5 = Upper left corner
6 = Bottom left corner
8 = Right screen overflow
9 = Upper right corner
10 = Bottom right corner

ML programs can get these values from 'B' register.

PLACE (P0=4)

Unlike MOVE, PLACE does not assume that the object being moved is already on the screen. PLACE is more like `PUT` as it limits itself to copying object from storage onto the screen. The options for PLACE are exactly the same as these of MOVE.

REMOVE (P0=4)

With REMOVE, you simply "swap" the contents of the screen with the contents of storage. This function differs from MOVE (P2>7) in that the object in storage is displayed "as is," whereas MOVE performs internal pixel and mix adjustments. REMOVE is fast and it can be used to simulate blinking.

The figure to be removed is specified in P1.

COPY OBJECT (P0=5)

Sometimes you may want to perform a "tricky" effect or simply substitute one object for another. COPY duplicates an object. COPY does not like it when the new object has not been CREATEd, and when the size of the new object is less than the size of the object being copied. Both the object being copied and the new object must have the same MIX or NO-MIX definition.

In P1, specify the destination object. In P2, specify the object being copied.

OPERATE (P0=6)

Used to directly modify an object. In P2, specify the operation to be performed upon the object defined in P1.

P2=0: Clear the object to the value specified in P3.

P2=1: Perform a logical "NOT" operation on the object. If in a two-color `PMODE`, this will convert the object into its reverse colors.

P2=2: Make an "AND" operation

ANIMATIC
TABLE#I

FUNCTION	P0	P1	P2	P3	P4	P5	P6	P7
DEFINE	0	# FIGS	.	.	.	.	.	.
CREATE	1	.	0=NOMIX	X COORD	Y COORD	# COLS	# ROWS	0=ERROR
			¢0 MIX					1=FREEZE
								2=DISAPP.
								3=WRAP
MOVE	2	# FIG	0=ABS.	X	Y	.	.	IF TYPE MIX COLOR CODE (0-3)
			1=REL.	+X	+Y			
			2=LJOYSK	.	.			
			3=RJOYSK	.	.			
			4=LJOYSK	(X)	(Y)			
			5=RJOYSK	(X)	(Y)			
			6=RANDOM	→ X	↓ Y	+X	+Y	
			7=KEYBRD	+X	+Y	.	.	
			8=REDISP	.	.			
PLACE	3	◄········	SAME	AS	MOVE	············	············	········►
REMOVE	4	# FIG	.	.	.	.	.	.
COPY	5	TO FIG	FROM FIG	.	.	.	.	.
OPERATE	6	# FIG	0=CLEAR	OPERATION BYTE	.	.	.	.
			1=NOT					
			2=AND					
			3=OR					
DOMAIN	7	# FIG	0	X ←	Y ↑	→ X	↓ Y	.
			# FIG	.	.	.	.	
INFO	8	A	B					

against the value specified in P3.

P3=3: Make an "OR" against the value in P3.

For NO-MIX objects, the changes will immediately be represented on the screen, but for MIX objects the changes will not appear until the next time you move your object.

CHECK DOMAIN (P0=7)

With DOMAIN you can test if an object "touches" a specific screen area. This function is used in program Listing 2 to check for asteroids crashing with the spaceship.

Specify the object to be tested in P1. If P2 is not zero, this number will represent an object whose coordinates will be used to define the screen area. For example, to know if object 2 "touches" object 5, code P1=2, P2=5. If P2=0, then P3 through P6 define the X-Y cordinates of the area's corners. If the object touches a point within this square, a '1' value is returned.

GENERAL INFO (P0=8)

To call this function from ML programs, make a JSR INFO. The arguments should be given in registers 'A' and 'B.'

With INFO you can obtain information about *Animatic* depending upon the P1 and P2 values. "NZ" represents a value other than zero in the table below.

P1	P2	Result
=0	=0	Address of an internal parameter table (required by ML programs). Also clears to zero the parameter table.
=0	NZ	XY coordinates for the NZ object. The result of the XY coordinates has the format &HXXYY.
=1	NZ	Address of internal Figure Definitions for object NZ. (Do not expect to use this function too often.)

Error Messages

Animatic returns error codes with the following format:

`"WW ERROR ON FIGURE YYY ACTION Z"`

YYY is the number of the object you were using when the error occurred and 'Z' is the number of the attempted function. If in BASIC, you'll also get an ?FC Error. When calling *Animatic* from Assembler, the error will be displayed and control returns to your program. You will be notified through a non-zero value in the 'A' register. (This does not apply for calls to INFO.)

What about WW? Following find its meaning:

XOS= Out of Screen. You selected P7=0 during function P0=1 for this object and have attempted to move the object to an overflow position.

XOM= There is not enough memory to create the object. If possible, relocate *Animatic* to a lower address. The program in Listing 3 will help you to determine an appropiate offset for *Animatic*.

XOF= You are trying to CREATE more objects than specified in DEFINE.

XIO= Invalid option. The requested function does not exist (valid options are 0-8 for BASIC and 0-7 for ML programs).

XEX= You are trying to CREATE an object more than 100 pixels wide or with a width of zero pixels.

XEY= You are trying to CREATE an object more than 100 pixels high or with a height of zero.

XNC= Object not created. The object you are trying to use has not been CREATEd.

XNI= You forgot to DEFINE (P0=0) *Animatic*.

XIC= Can't copy object. See description for the COPY function and see if you are violating some of the restrictions.

Some Things to Know

Animatic takes about 2.5K of storage, plus the required storage to keep the objects. It is written in PIC code and works on any CoCo with at least 16K and Extended BASIC. Disk is not required.

Although *Animatic* runs in 16K systems, you will need a 32K system and *EDTASM+* to enter and assemble the program. RAINBOW ON TAPE is an excellent alternative. You may also send me a SASE with a formatted diskette plus $4 (U.S. currency).

Listing 4 contains the source code. The program is so large that I do not recommend typing all the comments.

Program 3 will estimate the required size for your figures, and it suggests a load address for *Animatic*. After assembling the code, make a `CLEAR 200,LOAD ADDRESS-1`.

If using *Animatic* from BASIC, type in `EXEC` after loading it. Nothing should happen after typing `EXEC` and the cursor must continue blinking as normal. At this point, BASIC already recognizes the ANIM instruction. Because of this new instruction, avoid the use of `USR0` and `USR1` while in BASIC.

For a start, you may try sample programs 1 and 2. If after running a BASIC-*Animatic* program and you get ?SN Errors or you see '!' instead of ANIM when listing your program, this means you forgot to type `EXEC` after loading *Animatic*.

With *Animatic*, I have tried to provide a lot of functions and an easy interface for animation purposes. However, when used in complex animation environments, several considerations and restrictions inherent in its design have to be taken into account.

The potential for combinations in the animation functions here provided is such that it would require a more lengthy article to describe all possible effects, restrictions and techniques. I do encourage you to experiment whenever you have doubts. Of course, I would like to hear from you if you have questions, comments or problems regarding *Animatic*. You may contact me at 20819 Via Valencia, Boca Raton, FL 33433.

Listing 1: ROCKET

```
10 'THIS PROGRAMS MOVES A ROCKET
 FROM LEFT TO RIGHT OF THE SCREE
N
20 'PREPARE GRAPHICS AND DRAW RO
CKET
30 PCLEAR 4
40 PMODE 4,1
50 PCLS
60 SCREEN 1,1
70 X=10:Y=10
80 DRAW "BM10,10; S2;H10;R15;F10
;R20;F10;G10;L20;G10;L15;E10;U20
;D4;NL8;D4;NL12;D4NL16;D4;NL12;D
4;NL8"
90 'DEFINE ANIMATIC. MAX 1 FIGUR
E
```

```
100 A=ANIM(0,1)
110 'CREATE FIGURE: NO MIX, FROM
 X=0 Y=0, X SIZE=35, Y SIZE=35,
IF OUT OF SCREEN WRAP AROUND
120 A=ANIM(1,,0,0,0,X*3.5,Y*3.5,
3)
130 A$=INKEY$:IF A$="" THEN 130
140 PCLS
150 'MOVE FIGURE #1. RELATIVE MO
VEMENT OF +5 IN X AND 0 IN Y
160 X=ANIM(2,1,1,5,0)
170 GOTO 160
```

```
170 .......77
320 ......155
500 ......177
720 ........1
END .....210
```

Listing 2: PROMNADE

```
10 'SPACE PROMENADE WITH ANIMATI
C
20 GOTO 420
30 'DEFINE ANIMATIC. #FIGS=D+SPA
CESHIP+BOMB (D=#ASTEROIDS)
40 A=ANIM(0,D+2)
50 'CREATE SPACESHIP. NO MIX. PO
SITIONS X=0/Y=0, SIZE=35/20. IF
OUT OF SCREEN FREEZE
60 A=ANIM(1,,0,0,5,X*3.5,Y*2,1)
70 'CREATE ASTEROIDS. NO MIX. FR
OM POSITION 95,95. SIZE 11/11. I
F OUT OF SCREEN WRAP-AROUND
80 FOR I=1 TO D
90 A=ANIM(1,,0,95,95,11,11,3)
100 NEXT
110 'CREATE BOMB. NO MIX. FROM P
OSITION 200,184. SIZE=6 X 6. IF
OUT OF SCREEN WRAP
120 A=ANIM(1,,0,200,184,6,6,3)
130 'PREPARE SCREEN'S BACKGROUND
 (PLANET + STARS)
140 PCLS:CIRCLE(255,191),10:PAIN
T(250,189),1,1
150 FOR I=1 TO 60:PSET(RND(255),
RND(191),1):NEXT:SCREEN 1,1
160 ' SET ORIGINAL ASTEROIDS POS
ITIONS.
170 FOR I=2 TO D+1:S=INT(240/D)*
(I-1):X=ANIM(2,I,0,S,0):NEXT
180 'MAIN LOOP. MOVE SPACESHIP (
OBJECT#1). F2 CAN BE 4 IF JOYSTI
CK OR 7 IF KEYBOARD. F3 AND F4 A
RE X AND Y INCREMENTS
190 R=ANIM(2,1,F2,F3,F4):GOSUB31
0:'GO TO CHECK FOR CRASH
200 'MOVE ASTEROIDS. RELATIVE WI
TH X AND Y INCREMENTS DEPENDING
ON THE NUMBER OF THE OBJECT
210 FOR I=2 TO D+1:XA=ANIM(2,I,1
,&HFE,8+I*2):NEXT
220 'MOVE BOMB. RANDOM X=RND(30)
+150, Y=RND(151)+20
230 RA=ANIM(2,D+2,6,30,151,150,2
0)
240 'CHECK FOR CRASH
250 GOSUB 310
260 'REMOVE BOMB TO PREVENT OVER
LAPS WITH ASTEROIDS
270 RA=ANIM(4,D+2)
280 'IF R=10 THEN SPACESHIP REAC
HED BOTTOM/RIGHT CORNER
290 IF R<>10 THEN 190 ELSE 370
300 'CHECK IF SPACESHIP IS IN SA
ME DOMAIN THAT ANY OF THE ASTERO
IDS OR BOMB
310 FOR I=2 TO D+2:XA=ANIM(7,I,1
):IF XA<>0 THEN GOTO 360 ELSE NE
XT:RETURN
320 'OPERATE THE CRASHING ASTERO
ID BY CLEARING IT TO RED (TO SIM
ULATE FIRING)
330 A=ANIM(6,I,0,&HAA)
340 'MAKE SOUNDS AND FLASH SCREE
N
350 'ALMOST ALL THE CODE FROM HE
RE TO THE END IS COSMETIC
360 FOR I=1 TO 3:PLAY"T100;O1;F#
C":SCREEN 1,0:FOR J=1 TO20:NEXT:
SCREEN 1,1:NEXT:W=0:GOTO 380
370 FOR I=1 TO 2:PLAY"T250CDEFG"
:NEXT:PLAY "O3;L4;C;L2;D;A":W=8
380 CLS(W):PRINT@290,"";:INPUT "
ANOTHER GAME (Y/N)";A$
390 IF A$="N" THEN CLS:PRINT"I'L
L SEE YOU LATER":END
400 FL=1:GOTO 440
410 'INITIALIZE
420 PCLEAR 4
430 PMODE 4,1
440 PCLS
450 X=10:Y=10
460 DRAW "BM10,10; S2;H10;R15;F1
0;R20;F10;G10;L20;G10;L15;E10;U2
0;D4;NL8;D4;NL12;D4NL16;D4;NL12;
D4;NL8"
470 PAINT (12,12),1,1
480 CIRCLE (100,100),5
490 LINE (200,180)-(205,185),PSE
T,BF
500 'IF NOT FIRST TIME CONTINUE
510 IF FL=1 THEN 40
520 'SHOW PRESENTATION SCREEN
530 CLS(0)
540 'PRINTPEEK(&HFF00):A$=INKEY$
:IF A$="" THEN 301 ELSE POKE &HF
```

```
F02,&H00:PRINTPEEK(&HFF00):END
550 PRINT@8,"space";:PRINT@14,"p
romenade";
560 PRINT@64,"a";:PRINT@66,"grap
hics";:PRINT@75,"ANIMATIC";:PRIN
T@84,"program";
570 PRINT@106,"by";:PRINT@109,"r
ita";:PRINT@114,"sabo";
580 FOR I=0 TO 63:SET(I,10,7):SE
T(I,31,7):NEXT
590 FOR I=10 TO 31:SET(0,I,7):SE
T(63,I,7):NEXT
600 PRINT@230,"INSTRUCTIONS (Y/N
)?";
610 A$=INKEY$:IF A$="" THEN 610
620 IF A$<>"Y" THEN GOTO 770
630 'PRESENT INSTRUCTIONS
640 PRINT@230,STRING$(20,CHR$(12
8));
650 TX$(0)="your mission is to m
aneuver  "
660 TX$(1)="the spaceship thru t
he meteors"
670 TX$(2)="rain and successfuly
 cross the"
680 TX$(3)="contact bomb barrier
 to safely"
690 TX$(4)="arrive on the planet
 earth in"
700 TX$(5)="the bottom right--go
od luck!!"
710 TX$(6)="  press ENTER to con
tinue  "
720 PO=225:FOR I=0 TO 6:FOR J=1T
O 30:A$=MID$(TX$(I),J,1):IF A$="
 " THEN A$="":PLAY"T250O4D"  ELS
E PLAY"T250L1O1C"
730 PRINT@PO,A$;:FORH=1TO10:NEXT
:PO=PO+1:GOSUB860:FOR K=1 TO 50:
NEXT:NEXT:PO=PO+2:IF I=5 THEN PO
=PO+32
740 NEXT
750 A$=INKEY$:IF A$="" THEN GOSU
B 860:GOTO 750
760 'PRESENT GAME OPTIONS
770 CLS(5):PRINT@290,"";:INPUT "
HOW MANY ASTEROIDS";D
780 IF D<1 THEN 770 ELSE IF D>6
THEN SOUND 1,1:PRINT@362,"MASOCH
ISTIC?!!";:PRINT@384,"above 6 is
 too much even for you":FORI=1 T
O 1500:NEXT:GOTO770
790 PRINT@360,"jOYSTICK/kEYBOARD
";
800 PRINT@389,"(WITH JOYSTICK IS
 EASIER)";
810 A$=INKEY$:IF A$="" THEN 810
820 IF A$<>"K" AND A$<>"J" THEN
SOUND 1,1:GOTO 790
830 SOUND 200,1
840 IF A$="K" THEN F2=7:F3=8:F4=
8 ELSE F2=4:F3=4:F4=4
850 GOTO 40
860 IF SW=0 THEN PRINT@75,"ANIMA
TIC"; ELSE PRINT@75,STRING$(8,CH
R$(128));
870 SW=NOT SW:RETURN
```

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170 ....**53**
400 ....**46**
END **100**

Listing 3: ANIMCALC

```
10 'THIS PROGRAM WILL CALCULATE
THE REQUIRED SIZES FOR ANIMATIC'
S OBJECTS.
20 'IT WILL ALSO SUGGEST A START
 ADDRESS FOR ANIMATIC'S CODE
30 CLS:PRINT"ANIMATIC'S WORK ARE
AS SIZES"
40 INPUT"NUMBER OF OBJECTS";OB
50 IF OB<1 OR OB>255 THEN 40
60 DIM OB(OB),PM(OB),X(OB),Y(OB)
,MX$(OB)
70 FOR I=1 TO OB
80 CLS(5)
```

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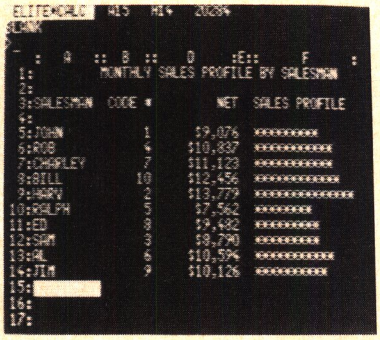
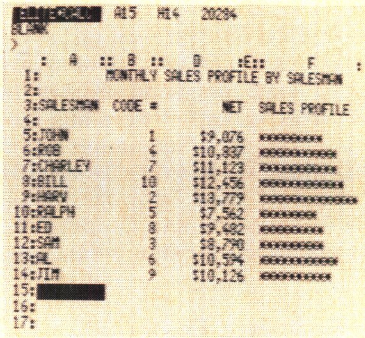


```
ELITE•CALC  A15  H14  20284
BLANK
>
  :  A  :: B ::   D    :E::    F    :
 1:         MONTHLY SALES PROFILE BY SALESMAN
 2:
 3:SALESMAN  CODE #       NET  SALES PROFILE
 4:
 5:JOHN         1      $9,076  *********
 6:ROB          4     $10,837  ***********
 7:CHARLEY      7     $11,123  ***********
 8:BILL        10     $12,456  ************
 9:HARV         2     $13,779  **************
10:RALPH        5      $7,562  ********
11:ED           8      $9,482  *********
12:SAM          3      $8,790  *********
13:AL           6     $10,594  ***********
14:JIM          9     $10,126  **********
15:
16:
17:
```



```
ELITE•CALC  A15  H14  20284
BLANK
>
  :  A  :: B ::   D    :E::    F    :
 1:         MONTHLY SALES PROFILE BY SALESMAN
 2:
 3:SALESMAN  CODE #       NET  SALES PROFILE
 4:
 5:JOHN         1      $9,076  *********
 6:ROB          4     $10,837  ***********
 7:CHARLEY      7     $11,123  ***********
 8:BILL        10     $12,456  ************
 9:HARV         2     $13,779  **************
10:RALPH        5      $7,562  ********
11:ED           8      $9,482  *********
12:SAM          3      $8,790  *********
13:AL           6     $10,594  ***********
14:JIM          9     $10,126  **********
15:
16:
17:
```

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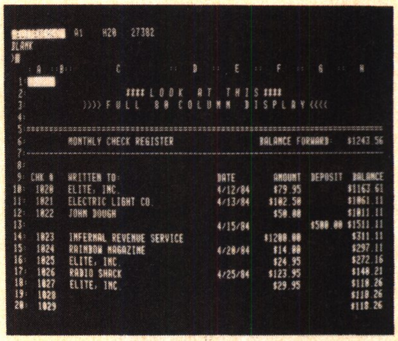

```
           A1   H20  27382
BLANK
>
 : A :B:        C        :: D :: E :: F :: G :: H
 1:
 2:            #### L O O K   A T   T H I S ####
 3:        >>>> F U L L   8 0   C O L U M N   D I S P L A Y <<<<
 4:
 5:=====================================================================
 6:      MONTHLY CHECK REGISTER                BALANCE FORWARD:  $1243.56
 7:---------------------------------------------------------------------
 8:
 9: CHK #  WRITTEN TO:                 DATE      AMOUNT  DEPOSIT  BALANCE
10:  1020  ELITE, INC.                 4/12/84   $79.95           $1163.61
11:  1021  ELECTRIC LIGHT CO.          4/13/84  $102.50           $1061.11
12:  1022  JOHN DOUGH                            $50.00           $1011.11
13:                                    4/15/84          $500.00  $1511.11
14:  1023  INFERNAL REVENUE SERVICE            $1200.00           $311.11
15:  1024  RAINBOW MAGAZINE            4/20/84   $14.00           $297.11
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>
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>
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```
90 PRINTTAB(20);"object #";:PRIN
TUSING"###";I
100 INPUT "OBJECT TO BE MIXED (Y
/N)";MX$
110 IF MX$<>"Y" AND MX$<>"N" THE
N 100
120 INPUT "PMODE (0-4)";PM
130 IF PM<0 OR PM>4 THEN 120
140 INPUT "WIDTH IN PIXELS (1-10
0)";X
150 IF X<1 OR X>100 THEN 140
160 INPUT "HEIGHT IN PIXELS (1-1
00)";Y
170 IF MX$="Y" THEN MX=1 ELSE MX
=0
180 PM(I)=PM:X(I)=X:Y(I)=Y:MX$(I
)=MX$
190 IF Y<1 OR Y>100 THEN 160
200 IF INT(X/2)<>X/2 AND PM<>4 T
HEN X=X+1
210 IF PM=0 OR PM=2 THEN X=INT(X
/2)
220 X=INT(X/8)
230 RM=7-X
240 X=X+1:IF RM>1 THEN X=X+1
250 IF (Y/2 <> INT(Y/2)) AND PM<
2 THEN Y=Y+1
260 IF PM<2 THEN Y=INT(Y/2)
270 T=X*Y
280 IF MX=1 THEN T=T*2
290 OB(I)=T
300 TT=TT+T
310 NEXT
320 CLS(7)
330 INPUT "ACTUAL OFFSET OF ANIM
ATIC";OF
340 INPUT"OUTPUT TO PRINTER";DV$
350 IF DV$="Y" THEN DV=-2 ELSE D
V=0
360 CLS
370 PRINT"OBJ# PMODE MIX   X
Y  BYTES"
380 FOR I=1 TO OB
390 PRINT#DV,USING"###    ";I;:PR
INT#DV,USING" #    ";PM(I);:PRINT
#DV," ";MX$;" ";:PRINT#DV,USING"
 ### ";X(I);:PRINT#DV,USING" ###
 ";Y(I);:PRINT#DV,USING" ####";O
B(I)
400 NEXT
410 PRINT#DV:PRINT#DV,TAB(11),"S
WAPS==>";:PRINT#DV,USING" ####";
TT
420 PRINT#DV:PRINT#DV,"          RE
QUIRED FDTS ==>";:PRINT#DV,USING
" ####";OB*24
430 TX=TT+OB*24
440 PRINT#DV:PRINT#DV,TAB(10),"T
OTAL ==>";:PRINT#DV,USING"####";
TX
450 PRINT#DV," ":PRINT#DV,"YOU C
AN RELOCATE ANIMATIC AT"
460 SZ=PEEK(&H74)*256+PEEK(&H75)
:AD=SZ-TX-2800
470 PRINT#DV,"ADDRESS: *";AD;"(H
EX=";HEX$(AD);") *"
480 AJ=AD-OF:IF AJ<0 THEN AJ=&HF
FFF+AJ+1
490 PRINT#DV,"MAKE:":PRINT#DV,"
LOADM 'ANIMATIC',";"&H"+HEX$(AJ)
+","+"&H"+HEX$(AJ+2800)+","+"&H"
+HEX$(AJ)
500 GOTO 500
```

Listing 4: ANIMATIC

```
                    00010 *== ANIMATIC. (C) 1983 BY RITA SABO ==*
                    00020 * BAS IS THE ROUTINE THAT HANDLES ANIM INST. *
          0000      00030 BAS     EQU    *
0000 CE   0139      00040         LDU    #$139
0003 A6   C4        00050         LDA    ,U
0005 81   02        00060         CMPA   #2
0007 2D   09        00070         BLT    NODSK
0009 33   4A        00080         LEAU   10,U
000B 6F   5B        00090         CLR    -5,U
000D 8E   B277      00100         LDX    #$B277
0010 AF   5E        00110         STX    -2,U
0012 86   01        00120 NODSK   LDA    #1
0014 A7   C0        00130         STA    ,U+
0016 30   8D 008E   00140         LEAX   BANIM,PCR
001A AF   C1        00150         STX    ,U++
001C 30   8D 000E   00160         LEAX   DUMEX,PCR
0020 AF   C1        00170         STX    ,U++
0022 8E   B277      00180         LDX    #$B277
0025 AF   43        00190         STX    3,U
0027 AF   48        00200         STX    8,U
0029 6F   40        00210         CLR    0,U
002B 6F   45        00220         CLR    5,U
002D 39             00230         RTS
```

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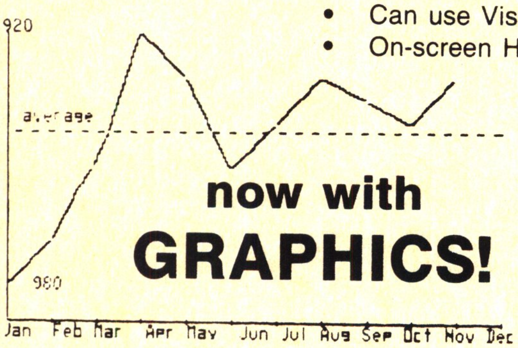

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```
          002E      00240 DUMEX    EQU    *
002E C0   44        00250          SUBB   #68         (80 IF DISK)
0030 B6   0139      00260          LDA    $139
0033 81   01        00270          CMPA   #1
0035 27   02        00280          BEQ    DUM2
0037 C0   0C        00290          SUBB   #12
0039 34   04        00300 DUM2     PSHS   B
003B BD   B26A      00310          JSR    $B26A
003E 35   04        00320          PULS   B
0040 BD   B73D      00330          JSR    $B73D
0043 1F   10        00340          TFR    X,D
0045 31   8D 09D9   00350          LEAY   PARMS,PCR
0049 E7   A0        00360          STB    ,Y+
004B 86   07        00370          LDA    #7
004D 34   22        00380 BMORE    PSHS   A,Y
004F BD   B26D      00390          JSR    $B26D
0052 E6   9F 00A6   00400          LDB    >[$A6]
0056 C1   2C        00410          CMPB   #',
0058 27   2C        00420          BEQ    BZERO
005A C1   29        00430          CMPB   #')
005C 26   06        00440          BNE    BL2
005E 86   01        00450          LDA    #1
0060 A7   E4        00460          STA    ,S
0062 20   22        00470          BRA    BZERO
          0064      00480 BL2      EQU    *
0064 BE   00A6      00490          LDX    >$A6
0067 86   08        00500          LDA    #8
0069 E6   80        00510 BL12     LDB    ,X+
006B C1   2C        00520          CMPB   #',
006D 27   10        00530          BEQ    BL3
006F C1   29        00540          CMPB   #')
0071 26   06        00550          BNE    BL22
0073 86   01        00560          LDA    #1
0075 A7   E4        00570          STA    ,S
0077 20   06        00580          BRA    BL3
0079 4A             00590 BL22     DECA
007A 26   ED        00600          BNE    BL12
007C 7E   B277      00610          JMP    $B277
007F BD   B73D      00620 BL3      JSR    $B73D
0082 1F   10        00630          TFR    X,D
0084 20   01        00640          BRA    BOUTL
0086 5F             00650 BZERO    CLRB
0087 35   22        00660 BOUTL    PULS   A,Y
0089 E7   A0        00670          STB    ,Y+
008B 4A             00680          DECA
008C 26   BF        00690          BNE    BMORE
008E BD   B267      00700          JSR    $B267
0091 86   01        00710          LDA    #1
0093 A7   8D 0998   00720          STA    5+FCTAB,PCR
0097 31   8D 0987   00730          LEAY   PARMS,PCR
009B A6   A0        00740          LDA    ,Y+
009D 81   08        00750          CMPA   #8
009F 1026 004F      00760          LBNE   ANIM
00A3 EC   A4        00770          LDD    ,Y
00A5 16   0008      00780          LBRA   INFO
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```
00A8      41        00790 BANIM    FCC    /ANI/
00AB      CD        00800          FCB    $CD
00AC                00810          RMB    4         TO MAKE INFO=BAS+$B0
                    00820 ************
                    00830 * INFO.
                    00840 *  ON ENTRY: D REGISTER WITH OPTIONS
                    00850 *   ON EXIT: D WITH ADDRESS OF FDT, PARMS OR XY
                    00860 ************
          00B0      00870 INFO     EQU    *
00B0 10EF 8D 0939   00880          STS    SAVSTK,PCR
00B5 30   8D 0969   00890          LEAX   PARMS,PCR
00B9 5D             00900          TSTB             PARMS ADDR?
00BA 26   0D        00910          BNE    ADFI      FDT ADDR
00BC 34   10        00920          PSHS   X
00BE 86   08        00930          LDA    #8        CLEAR PARMS
00C0 6F   80        00940 MCLPA    CLR    ,X+
00C2 4A             00950          DECA
00C3 26   FB        00960          BNE    MCLPA
00C5 35   06        00970          PULS   D
00C7 20   1E        00980          BRA    EXINF
00C9 34   02        00990 ADFI     PSHS   A
00CB A6   01        01000          LDA    1,X
00CD 34   02        01010          PSHS   A
00CF E7   01        01020          STB    1,X
00D1 17   0773      01030          LBSR   GETFDT
00D4 35   02        01040          PULS   A
00D6 A7   01        01050          STA    1,X
00D8 35   02        01060          PULS   A
00DA 4D             01070          TSTA             XY-COORD.
00DB 26   08        01080          BNE    ADFI2
00DD A6   C8 08     01090          LDA    <AUTOX,U        X-COORD
00E0 E6   C8 09     01100          LDB    <AUTOY,U        Y-COORD
00E3 20   02        01110          BRA    EXINF
00E5 1F   30        01120 ADFI2    TFR    U,D       RESULT
00E7 6D   8D 0944   01130 EXINF    TST    5+FCTAB,PCR     RETURN TO ML?
00EB 27   03        01140          BEQ    RETINF
00ED 7E   B4F4      01150          JMP    $B4F4     TO BASIC
00F0 39             01160 RETINF   RTS              TO ML
00F1 12             01170          NOP              ANIM=INFO+$40
                    01180 *------------------------------*
                    01190 * ANIMATIC. ASSEMBLY ENTRY POINT*
                    01200 *   ON ENTRY: PARMS SET
                    01210 *   ON EXIT: X= ADDR. OF PARMS  *
                    01220 *------------------------------*
          00F2      01230 ANIM     EQU    *
00F2 10EF 8D 08F7   01240          STS    SAVSTK,PCR      SAVE STACK ADDRESS
00F7 32   8D 0926   01250          LEAS   49+STACK,PCR    NEW STACK ADDRESS
00FB 6F   8D 08B9   01260          CLR    STATUS,PCR      CLEAR STATUS AREA
00FF 6F   8D 08B6   01270          CLR    1+STATUS,PCR
0103 30   8D 091B   01280          LEAX   PARMS,PCR       LOAD PARMS ADDR.
0107 A6   84        01290          LDA    ,X        GET REQUESTED FUNCTION
0109 A7   8D 089B   01300          STA    ACTION,PCR      SAVE REQUESTED ACTION
010D C6   08        01310          LDB    #8        CHECK FOR ACTION
010F E1   84        01320          CMPB   ,X
0111 22   05        01330          BHI    GRA2      IF OK CONTINUE
0113 C6   03        01340          LDB    #XIO      ELSE ERROR
0115 16   0815      01350          LBRA   ERROR
0118 C6   03        01360 GRA2     LDB    #3        GET DISPLACEMENT
011A 3D             01370          MUL
011B 31   8D 0002   01380          LEAY   CALLS,PCR       ADDR. OF CALL LIST
011F 6E   A5        01390          JMP    B,Y       GO TO APPROPIATE CALL
          0121      01400 CALLS    EQU    *
0121 16   0015      01410          LBRA   INIT      INITIALIZE
0124 16   003B      01420          LBRA   CREATE    CREATE FIGURE
0127 16   00F9      01430          LBRA   MOVE      MOVE FIGURE
012A 16   00F6      01440          LBRA   PLACE     PLACE FIG. ON SCREEN
012D 16   02B8      01450          LBRA   REMOVE    ERASE FIG. FROM SCREEN
0130 16   02C4      01460          LBRA   COPYFI    COPY FIGURE
0133 16   0372      01470          LBRA   OPERAT    OPERATE SWAP AREA WITH FUNCTION
0136 16   0320      01480          LBRA   DOMAIN    FIND IN A DOMAIN
                    01490 *-----------------------*
                    01500 *INITIALIZE FCT (FIGURE  *
                    01510 * CONTROL TABLE) ACT. 0  *
                    01520 *  ON ENTRY: X=ADDR. OF  *
                    01530 *            PARMS       *
                    01540 *-----------------------*
          0139      01550 INIT     EQU    *
0139 A6   01        01560          LDA    1,X       NUMBER OF FIGS.
013B 26   05        01570          BNE    INI2      NUMBER OF FIGS.
013D C6   02        01580          LDB    #XOF      CAN'T BE ZERO
013F 16   07EB      01590          LBRA   ERROR
0142 A7   8D 08E4   01600 INI2     STA    FCTAB,PCR
0146 C6   18        01610          LDB    #24       GET ADDRESS FOR SWAP AREA
0148 3D             01620          MUL              #BYTES FOR FFDT'S
0149 31   8D 08E3   01630          LEAY   FFDT,PCR        FIRST FFDT ADDRESS
014D 34   20        01640          PSHS   Y
014F E3   E1        01650          ADDD   ,S++      ADD TO BYTES FOR FFDT'S
0151 ED   8D 08D8   01660          STD    3+FCTAB,PCR     ADDR. OF FIRST SWAP AREA
0155 6F   8D 08D2   01670          CLR    1+FCTAB,PCR     NUMBER OF CREATED FIGS.
0159 86   AA        01680          LDA    #$AA      INIT FLAG
015B A7   8D 08CD   01690          STA    2+FCTAB,PCR
015F 16   082E      01700          LBRA   EXIT
                    01710 *-----------------------*
                    01720 * CREATE FIGURE (ACT. 1) *
                    01730 * ON ENTRY: X= ADDR. OF  *
                    01740 *           PARMLIST     *
                    01750 *-----------------------*
          0162      01760 CREATE   EQU    *
0162 31   8D 08C4   01770          LEAY   FCTAB,PCR       ADDR. OF FCT
0166 6C   8D 08C1   01780          INC    1+FCTAB,PCR     NUMBER OF FIGS CREATED
016A A6   8D 08BD   01790          LDA    1+FCTAB,PCR
016E A7   01        01800          STA    1,X       STORE IT IN PARMS
0170 17   06D4      01810          LBSR   GETFDT
0173 EC   A8 03     01820          LDD    <NEXTSW,Y       NEXT SWAP AREA
0176 ED   C8 00     01830          STD    <ASW,U  STORE IT IN FDT
0179 A6   03        01840          LDA    3,X       X-COORD.
017B A7   8D 0825   01850          STA    CADX,PCR
017F A6   04        01860          LDA    4,X       Y-COORD.
0181 A7   8D 0821   01870          STA    CADY,PCR
0185 A6   07        01880          LDA    7,X       ACTION IF OUT-OF-SCREEN
0187 A7   C8 10     01890          STA    <OUTSCR,U
018A E6   05        01900          LDB    5,X       #COLS.
018C 27   04        01910          BEQ    CER1      =0?
018E C1   65        01920          CMPB   #101      MASX. NUMBER OF X PIXELS
0190 25   05        01930          BLO    CRA       OK
0192 C6   04        01940 CER1     LDB    #XEX      ELSE ERROR
```

```
0194 16   0796      01950         LBRA   ERROR
0197 E7   C8 04     01960 CRA     STB    <WIDTH,U
019A 1F   98        01970         TFR    B,A      USE A REG.
019C 84   01        01980         ANDA   #1       TO SEE IF ODD NUMBER
019E 27   0A        01990         BEQ    CR1      IF EVEN CONTINUE
01A0 96   B6        02000         LDA    <$B6     ELSE GET PMODE
01A2 81   04        02010         CMPA   #4       IF PMODE 4
01A4 27   04        02020         BEQ    CR1      DO NOTHING
01A6 6C   C8 04     02030         INC    <WIDTH,U         ELSE ROUND-UP WIDTH
01A9 5C             02040         INCB
01AA 17   0668      02050 CR1     LBSR   CMAXBY   FIND MAX. # OF BYTES
01AD A6   06        02060         LDA    6,X      #ROWS
01AF 27   04        02070         BEQ    CER2     =0?
01B1 81   65        02080         CMPA   #101     MAX. NUMBER OF Y PIXELS
01B3 25   05        02090         BLO    CRB      OK
01B5 C6   05        02100 CER2    LDB    #XEY     ELSE ERROR
01B7 16   0773      02110         LBRA   ERROR
01BA A7   C8 05     02120 CRB     STA    <HEIGHT,U
01BD 84   01        02130         ANDA   #1       TO SEE IF ODD NUMBER
01BF 27   09        02140         BEQ    CR2      IF EVEN CONTINUE
01C1 96   B6        02150         LDA    <$B6     ELSE GET PMODE
01C3 81   01        02160         CMPA   #1       IF PMODES 2,3,4
01C5 22   03        02170         BHI    CR2      DO NOTHING
01C7 6C   C8 05     02180         INC    <HEIGHT,U        ELSE ROUND-UP HEIGHT
01CA 17   0664      02190 CR2     LBSR   NORMY    FIND #BYTES FOR ROWS
01CD 3D             02200         MUL             TOTAL BYTES FOR FIGURE
01CE ED   C9 0012   02210         STD    FIGBYT,U
01D2 6D   02        02220         TST    2,X      MIXABLE?
01D4 27   0C        02230         BEQ    CR3      NO
01D6 AE   A8 03     02240         LDX    <NEXTSW,Y
01D9 30   8B        02250         LEAX   D,X      POINT TO SWAP FOR MIX.
01DB AF   C8 02     02260         STX    <ORFLAG,U
01DE 58             02270         ASLB            MULTIPLY BYTES BY 2
01DF 49             02280         ROLA
01E0 20   03        02290         BRA    CR32
01E2 6F   C8 02     02300 CR3     CLR    <ORFLAG,U        NO-MIX
01E5 AE   A8 03     02310 CR32    LDX    <NEXTSW,Y
01E8 6F   80        02320 CR4     CLR    ,X+      CLEAR TO ZERO
01EA 83   0001      02330         SUBD   #1       NUMBER OF BYTES FOR NEW SWAP
01ED 26   F9        02340         BNE    CR4      NOT DONE YET
01EF AF   A8 03     02350         STX    <NEXTSW,Y        TO NEXT SWAP AREA
01F2 9C   74        02360         CMPX   $74      EXCEEDS AVAILABLE MEMORY?
01F4 23   05        02370         BLS    CRC      NO, OK
01F6 C6   01        02380         LDB    #XOM     ELSE ERROR
01F8 16   0732      02390         LBRA   ERROR
          01FB      02400 CRC     EQU    *
01FB 17   038A      02410         LBSR   MOVGEN
01FE 4F             02420         CLRA
01FF 17   04FE      02430         LBSR   SWAP2   GET FIGURE
0202 6D   C8 02     02440         TST    <ORFLAG,U        OR-ABLE?
0205 27   13        02450         BEQ    ENDCRE  ...NO EXIT
0207 A6   C8 0A     02460         LDA    <LMASK,U
020A A7   C8 0C     02470         STA    <OLMASK,U
020D A6   C8 0B     02480         LDA    <RMASK,U
0210 A7   C8 0D     02490         STA    <ORMASK,U
```

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0213 A6   C8 0E     02500         LDA    <WIDBYT,U
0216 A7   C9 0014   02510         STA    OWID,U
021A 86   01        02520 ENDCRE  LDA    #1       FLAG AS NEW
021C A7   C9 0011   02530         STA    FLAGCR,U
0220 16   076D      02540         LBRA   EXIT
                    02550 *----------------------------*
                    02560 *    MOVE FIGURE (ACT. 2)    *
                    02570 * ON ENTRY: X= ADDR. OF      *
                    02580 *              PARMLIST      *
                    02590 *----------------------------*
          0223      02600 MOVE    EQU    *
          0223      02610 PLACE   EQU    *        PLACE ALSO BEGINS HERE
0223 6F   8D 077C   02620         CLR    CACX,PCR
0227 6F   8D 077A   02630         CLR    CACY,PCR
022B 17   0619      02640         LBSR   GETFDT
022E 6D   C9 0011   02650         TST    FLAGCR,U         FIG. JUST CREATED?
0232 27   0A        02660         BEQ    MO1      NO GO AHEAD
0234 86   03        02670         LDA    #3       FORCE ACTION 3 (PLACE)
0236 A7   8D 076E   02680         STA    ACTION,PCR
023A 6F   C9 0011   02690         CLR    FLAGCR,U         DELETE JUST CREATED FLAG
          023E      02700 MO1     EQU    *
023E A6   02        02710         LDA    2,X
0240 26   0F        02720         BNE    SPEMOV
0242 E6   03        02730         LDB    3,X
0244 E7   8D 075C   02740         STB    CADX,PCR         X-DEST
0248 E6   04        02750         LDB    4,X
024A E7   8D 0758   02760         STB    CADY,PCR         Y-DEST
024E 16   014D      02770         LBRA   XMOVE
0251 81   01        02780 SPEMOV  CMPA   #1
0253 26   25        02790         BNE    RNDXY
0255 4F             02800         CLRA
0256 E6   C8 08     02810         LDB    <AUTOX,U         RELATIVE MOVEMENT
0259 34   06        02820         PSHS   D
025B E6   03        02830         LDB    3,X      GET INCR. IN X
025D 2A   01        02840         BPL    CONX     NEGATIVE?
025F 43             02850         COMA
0260 E3   E1        02860 CONX    ADDD   ,S++     ADD IT
0262 ED   8D 073D   02870         STD    CACX,PCR         X-DEST.
0266 4F             02880         CLRA
0267 E6   C8 09     02890         LDB    <AUTOY,U         UPDATE Y
026A 34   06        02900         PSHS   D
026C E6   04        02910         LDB    4,X      GET INCR. IN Y
026E 2A   01        02920         BPL    CONY     NEGATIVE?
0270 43             02930         COMA
0271 E3   E1        02940 CONY    ADDD   ,S++     ADD IT
0273 ED   8D 072E   02950         STD    CACY,PCR         Y-DEST.
0277 16   0124      02960         LBRA   XMOVE
027A 81   06        02970 RNDXY   CMPA   #6       IS X-Y RANDOM REQUESTED?
027C 26   25        02980         BNE    NORAN
027E A6   03        02990         LDA    3,X      GET MAX. ALLOWED COLUMN
0280 26   04        03000         BNE    NODFX    IF NOT ZERO CONTINUE
0282 86   FF        03010         LDA    #255     ELSE PUT DEFAULT
0284 6F   05        03020         CLR    5,X
0286 17   05F4      03030 NODFX   LBSR   RANDOM   GET RANDOM VALUE
0289 EB   05        03040         ADDB   5,X
```

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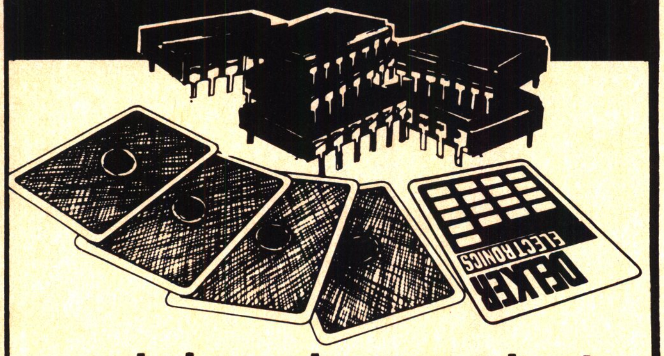

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028B E7   8D 0715  03050        STB   CADX,PCR         AND STORE NEW X-COORD.
028F A6   04       03060        LDA   4,X     MAX. ALLOWED ROW
0291 26   04       03070        BNE   NODFY   IF NOT ZERO CONTINUE
0293 86   BF       03080        LDA   #191    ELSE PUT DEFAULT
0295 6F   06       03090        CLR   6,X
0297 17   05E3     03100 NODFY  LBSR  RANDOM  GET RANDOM VALUE
029A EB   06       03110        ADDB  6,X
029C E7   8D 0706  03120        STB   CADY,PCR         NEW Y-COORD.
02A0 16   00FB     03130        LBRA  XMOVE   CONTINUE
02A3 102D 0080     03140 NORAN  LBLT  RDJOY
02A7 81   07       03150        CMPA  #7
02A9 26   6B       03160        BNE   STAY
02AB 86   BF       03170        LDA   #$BF    KEYBOARD CONTROL
02AD B7   FF02     03180        STA   $FF02
02B0 4F            03190        CLRA
02B1 E6   C8 08    03200        LDB   <AUTOX,U
02B4 34   06       03210        PSHS  D
02B6 E6   03       03220        LDB   3,X
02B8 B6   FF00     03230        LDA   $FF00
02BB 81   F7       03240        CMPA  #247
02BD 26   07       03250        BNE   KBXP2
02BF 4F            03260        CLRA
02C0 E3   E4       03270        ADDD  ,S
02C2 ED   E4       03280        STD   ,S
02C4 E6   03       03290        LDB   3,X
02C6 77   FF02     03300 KBXP2  ASR   $FF02
02C9 B6   FF00     03310        LDA   $FF00
02CC 81   F7       03320        CMPA  #247
02CE 26   0A       03330        BNE   KBXEX
02D0 4F            03340        CLRA
02D1 50            03350        NEGB
02D2 27   02       03360        BEQ   KB2X
02D4 86   FF       03370        LDA   #$FF
02D6 E3   E4       03380 KB2X   ADDD  ,S
02D8 ED   E4       03390        STD   ,S
02DA EC   E1       03400 KBXEX  LDD   ,S++
02DC ED   8D 06C3  03410        STD   CACX,PCR
02E0 4F            03420        CLRA
02E1 E6   C8 09    03430        LDB   <AUTOY,U
02E4 34   06       03440        PSHS  D
02E6 E6   04       03450        LDB   4,X
02E8 77   FF02     03460        ASR   $FF02
02EB B6   FF00     03470        LDA   $FF00
02EE 81   F7       03480        CMPA  #247
02F0 26   07       03490        BNE   KBYP2
02F2 4F            03500        CLRA
02F3 E3   E4       03510        ADDD  ,S
02F5 ED   E4       03520        STD   ,S
02F7 E6   04       03530        LDB   4,X
02F9 77   FF02     03540 KBYP2  ASR   $FF02
02FC B6   FF00     03550        LDA   $FF00
02FF 81   F7       03560        CMPA  #247
0301 26   0A       03570        BNE   KBYEX
0303 4F            03580        CLRA
0304 50            03590        NEGB
0305 27   02       03600        BEQ   KB2Y
0307 86   FF       03610        LDA   #$FF
0309 E3   E4       03620 KB2Y   ADDD  ,S
030B ED   E4       03630        STD   ,S
030D EC   E1       03640 KBYEX  LDD   ,S++
030F ED   8D 0692  03650        STD   CACY,PCR
0313 16   0088     03660        LBRA  XMOVE
0316 A6   C8 08    03670 STAY   LDA   <AUTOX,U
0319 A7   8D 0687  03680        STA   CADX,PCR
031D A6   C8 09    03690        LDA   <AUTOY,U
0320 A7   8D 0682  03700        STA   CADY,PCR
0324 16   00BB     03710        LBRA  MO3
0327 34   52       03720 RDJOY  PSHS  U,X,A
0329 AD   9F A00A  03730        JSR   [$A00A] READ JOYSTICK
032D 35   52       03740        PULS  U,X,A   RESTORE
032F 108E 015A     03750        LDY   #$015A  ADDRESS OF VALUES
0333 81   02       03760        CMPA  #2      IF LEFT JOYST.
0335 27   06       03770        BEQ   EXPAND
0337 81   04       03780        CMPA  #4      LEFT JOYSTK?
0339 27   02       03790        BEQ   EXPAND  YES
033B 31   22       03800        LEAY  2,Y     POINT TO RIGHT JOYS VALUES
033D 80   04       03810 EXPAND SUBA  #4      XY INDICATOR-4
033F 2A   1C       03820        BPL   INCJY   JOYSTK. INCREMENT
0341 68   A4       03830        LSL   ,Y      MULTIPLY X-READING BY 4
0343 68   A4       03840        LSL   ,Y
0345 68   A4       03850        LSL   ,Y
0347 68   A4       03860        LSL   ,Y
0349 68   21       03870        LSL   1,Y     MULTIPLY Y READING BY 3
034B 68   21       03880        LSL   1,Y
034D 68   21       03890        LSL   1,Y
034F E6   A4       03900        LDB   ,Y      GET Y-COORD
0351 E7   8D 064F  03910        STB   CADX,PCR        STORE IT
0355 E6   21       03920        LDB   1,Y     GET     Y-COORD
0357 E7   8D 064B  03930        STB   CADY,PCR        STORE IT
035B 20   41       03940        BRA   XMOVE
          035D     03950 INCJY  EQU   *
035D A6   A4       03960        LDA   ,Y      GET X READING
035F 80   20       03970        SUBA  #32     MINUS 32
0361 A7   A4       03980        STA   ,Y
0363 A6   21       03990        LDA   1,Y     NOW Y-READING
0365 80   20       04000        SUBA  #32
0367 A7   21       04010        STA   1,Y
0369 86   03       04020        LDA   #3      NOW DIVIDE BY 8
036B 67   A4       04030 DIVCN  ASR   ,Y
036D 67   21       04040        ASR   1,Y
036F 4A            04050        DECA
0370 26   F9       04060        BNE   DIVCN
0372 A6   03       04070        LDA   3,X     GET X MULTIPLIER
0374 E6   A4       04080        LDB   ,Y      AND X READING
0376 3D            04090        MUL
0377 4D            04100        TSTA          CHECK IF RESULT SHOULD BE NEG.
0378 27   02       04110        BEQ   DIV1    POSITIVE
037A 86   FF       04120        LDA   #$FF    MAKE IT NEG.
037C 34   06       04130 DIV1   PSHS  D
037E 4F            04140        CLRA
037F E6   C8 08    04150        LDB   <AUTOX,U        ACTUAL X LOCATION
0382 E3   E1       04160        ADDD  ,S++    NEW LOCATION
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0384 ED   8D 061B  04170              STD   CACX,PCR         STORE IT
0388 A6   04       04180              LDA   4,X     Y-MULTIPLIER
038A E6   21       04190              LDB   1,Y     Y-READING
038C 3D            04200              MUL
038D 4D            04210              TSTA              IS RESULT NEGATIVE?
038E 27   02       04220              BEQ   DIV2    NO
0390 86   FF       04230              LDA   #$FF    MAKE IT NEGATIVE
0392 34   06       04240 DIV2         PSHS  D
0394 4F            04250              CLRA
0395 E6   C8 09    04260              LDB   <AUTOY,U         ACTUAL Y LOCATION
0398 E3   E1       04270              ADDD  ,S++    NEW Y POSITION
039A ED   8D 0607  04280              STD   CACY,PCR         STORE IT
          039E     04290 XMOVE        EQU   *
039E 6F   8D 060B  04300              CLR   FLG,PCR
03A2 6F   8D 0608  04310              CLR   1+FLG,PCR        MARK FLAG TO CHECK X
03A6 31   8D 05F9  04320              LEAY  CACX,PCR         ADDR. OF TENTATIVE X
03AA 17   0524     04330              LBSR  ACTOSC  VERIFY X<0 OR X>255
03AD 68   8D 0608  04340              LSL   1+STATUS,PCR     PREPARE FOR Y STATUS FLAG
03B1 68   8D 0604  04350              LSL   1+STATUS,PCR
03B5 86   40       04360              LDA   #64
03B7 A7   8D 05F3  04370              STA   1+FLG,PCR        FLAG TO CKECK Y
03BB 31   8D 05E6  04380              LEAY  CACY,PCR         ADDR. OF TENTATIVE Y
03BF 17   050F     04390              LBSR  ACTOSC  VERIFY Y<0 OR Y>191
03C2 6D   C8 02    04400              TST   <ORFLAG,U        MOVE WITH MIX?
03C5 27   1B       04410              BEQ   MO3     NO
03C7 A6   07       04420              LDA   7,X     IF MOVE WITH MIX
03C9 A7   8D 05E5  04430              STA   BKCOLO,PCR       STORE THE VALUE
03CD C6   03       04440              LDB   #3      COUNTER
          03CF     04450 MO2          EQU   *
03CF 68   8D 05DF  04460              ASL   BKCOLO,PCR       TO CONVERT
03D3 68   8D 05DB  04470              ASL   BKCOLO,PCR       COLOR CODE
03D7 AA   8D 05D7  04480              ORA   BKCOLO,PCR       TO $00,$55,$AA OR $FF
03DB 5A            04490              DECB
03DC 26   F1       04500              BNE   MO2
03DE A7   8D 05D0  04510              STA   BKCOLO,PCR
03E2 17   01A3     04520 MO3          LBSR  MOVGEN  GO TO MOVE FIG.
03E5 16   05A8     04530              LBRA  EXIT
                   04540 *-----------------------*
                   04550 * REMOVE FIGURE (ACT. 4) *
                   04560 * ON ENTRY: X= ADDR. OF  *
                   04570 *          PARMLIST      *
                   04580 *-----------------------*
          03E8     04590 REMOVE       EQU   *
03E8 17   045C     04600              LBSR  GETFDT  GET FDT ADDRESS
          03EB     04610 REMOV2       EQU   *
03EB 17   0312     04620              LBSR  SWAP2   GO AND REMOVE
03EE 86   01       04630              LDA   #1      MARK AS NEW
03F0 A7   C9 0011  04640              STA   FLAGCR,U
03F4 16   0599     04650              LBRA  EXIT
                   04660 *-----------------------*
                   04670 * COPY   FIGURE (ACT. 5) *
                   04680 * ON ENTRY: X= ADDR. OF  *
                   04690 *          PARMLIST      *
                   04700 *-----------------------*
          03F7     04710 COPYFI       EQU   *
03F7 E6   01       04720              LDB   1,X
03F9 34   04       04730              PSHS  B
03FB E6   02       04740              LDB   2,X     GET ADDR. OF FFDT FOR FROM-FIG.
03FD E7   01       04750              STB   1,X
03FF 17   0445     04760              LBSR  GETFDT
0402 1F   32       04770              TFR   U,Y     ADDR. OF FFDR
0404 35   04       04780              PULS  B       GET TO-FIG
0406 E7   01       04790              STB   1,X     AND RESTORE
0408 17   043C     04800              LBSR  GETFDT  ADDR. OF FFDT FRO TO-FIG
040B 1F   21       04810              TFR   Y,X     FFDT FOR FROM-FIG
040D C6   08       04820              LDB   #XIC    IF ERROR PREPARE ERROR CODE
040F 10AE 89 0012  04830              LDY   FIGBYT,X         NUMBER OF BYTES IN FIG.
0414 10AC C9 0012  04840              CMPY  FIGBYT,U         IF MORE THAN DESTINATION
0419 1022 0510     04850              LBHI  ERROR
041D A6   88 02    04860              LDA   <ORFLAG,X        IS FROM-FIG. ORABLE?
0420 A1   C8 02    04870              CMPA  <ORFLAG,U        THEY MUST BE SAME CLASS
0423 1026 0506     04880              LBNE  ERROR
0427 34   50       04890              PSHS  U,X
0429 4D            04900              TSTA            IF FIGS ARE MIXABLE
042A 27   08       04910              BEQ   CO2     NO
042C EE   C8 02    04920              LDU   <ORFLAG,U        DEST.
042F AE   88 02    04930              LDX   <ORFLAG,X        ORIGIN
0432 20   06       04940              BRA   CO22
0434 EE   C8 00    04950 CO2          LDU   <ASW,U  DESTINATION SWAP AREA
0437 AE   88 00    04960              LDX   <ASW,X  ORIGIN SWAP AREA
043A 17   048B     04970 CO22         LBSR  COPYSW  COPY AREAS
043D 35   50       04980              PULS  U,X     RESTORE FFDT ADDRESSES
043F 32   7C       04990              LEAS  -4,S    BUT KEEP IN STACK
0441 86   14       05000              LDA   #20     WE'LL COPY FFDT NOW
0443 33   44       05010              LEAU  4,U     EXCEPT FOR SWAP AREA ADDRESS
0445 30   04       05020              LEAX  4,X
0447 10AE 81       05030 CO3          LDY   ,X++    COPYING FFDT
044A 10AF C1       05040              STY   ,U++
044D 4A            05050              DECA
044E 26   F7       05060              BNE   CO3     IF NOT FINISHED CONTINUE
0450 35   50       05070              PULS  U,X     RESTORE FFDT ADDRESSES
0452 6F   C9 0011  05080              CLR   FLAGCR,U         FLAG AS NEW
          0456     05090 EXCOP        EQU   *
0456 16   0537     05100              LBRA  EXIT    THAT'S IT
                   05110 *-----------------------*
                   05120 * VERIFY IF FIGURE INSIDE*
                   05130 * AN SPECIFIED DOMAIN    *
                   05140 * ON ENTRY: X= ADDR. OF  *
                   05150 *          PARMLIST      *
                   05160 *-----------------------*
          0459     05170 DOMAIN       EQU   *
0459 A6   02       05180              LDA   2,X     IS DOMAIN DIRECTLY GIVEN?
045B 27   21       05190              BEQ   DOM2    YES
045D E6   01       05200              LDB   1,X     NO, DOMAIN BELONGS TO A FIG.
045F 34   04       05210              PSHS  B       GET FFDT FOR THAT FIG.
0461 A7   01       05220              STA   1,X
0463 17   03E1     05230              LBSR  GETFDT
0466 35   04       05240              PULS  B       RESTORE FIG. NUMBER
0468 E7   01       05250              STB   1,X
046A A6   C8 08    05260              LDA   <AUTOX,U         LEFT COL. OF DOMAIN
046D A7   03       05270              STA   3,X
046F AB   C8 04    05280              ADDA  <WIDTH,U         RIGHT COL. OF DOMAIN
0472 A7   05       05290              STA   5,X
0474 A6   C8 09    05300              LDA   <AUTOY,U         TOP ROW OF DOMAIN
0477 A7   04       05310              STA   4,X
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0479 AB   C8 05    05320              ADDA  <HEIGHT,U        BOTTOM ROW OF DOMAIN
047C A7   06       05330              STA   6,X
          047E     05340 DOM2         EQU   *       VERIFY IF IN DOMAIN
047E 17   03C6     05350              LBSR  GETFDT  FOR REQUESTED FIG.
0481 5F            05360              CLRB
0482 A6   C8 08    05370              LDA   <AUTOX,U         LEFT COL IS
0485 A1   05       05380              CMPA  5,X
0487 22   17       05390              BHI   OUTDOM  DOMAIN?
0489 AB   C8 04    05400              ADDA  <WIDTH,U
048C A1   03       05410              CMPA  3,X
048E 25   10       05420              BLO   OUTDOM
0490 A6   C8 09    05430              LDA   <AUTOY,U         IS TOP ROW BELOW BOTTOM
0493 A1   06       05440              CMPA  6,X     ROW OF DOMAIN?
0495 22   09       05450              BHI   OUTDOM
0497 AB   C8 05    05460              ADDA  <HEIGHT,U        IS BOTTOM ROW ABOVE TOP
049A A1   04       05470              CMPA  4,X     ROW OF DOMAIN?
049C 25   02       05480              BLO   OUTDOM
049E C6   01       05490              LDB   #1      WELL, INDEED IT TOUCHES DOMAIN
04A0 4F            05500 OUTDOM       CLRA
04A1 ED   8D 0513  05510              STD   STATUS,PCR       LET IT BE KNOWN
04A5 16   04E8     05520              LBRA  EXIT
                   05530 *-----------------------*
                   05540 * OPERATE FIGURE(ACT. 6) *
                   05550 * ON ENTRY: X= ADDR. OF  *
                   05560 *          PARMLIST      *
                   05570 *-----------------------*
          04A8     05580 OPERAT       EQU   *
04A8 17   039C     05590              LBSR  GETFDT  GET ADDR. OF FDT
04AB 6D   C8 02    05600              TST   <ORFLAG,U        MIXABLE?
04AE 27   05       05610              BEQ   NOMIX
04B0 EC   C8 02    05620              LDD   <ORFLAG,U
04B3 20   16       05630              BRA   MIXC
04B5 6D   C9 0011  05640 NOMIX        TST   FLAGCR,U
04B9 26   0D       05650              BNE   NOMI2
04BB 86   04       05660              LDA   #4
04BD A7   8D 04E7  05670              STA   ACTION,PCR
04C1 34   10       05680              PSHS  X
04C3 17   023A     05690              LBSR  SWAP2
04C6 35   10       05700              PULS  X
04C8 EC   C8 00    05710 NOMI2        LDD   <ASW,U  GET ADDR. OF SWAP AREA
04CB 10AE C9 0012  05720 MIXC         LDY   FIGBYT,U         NUMBER OF BYTES IN FIG.
04D0 34   46       05730              PSHS  U,D
04D2 1F   03       05740              TFR   D,U     GOODBYE ADDR. OF FDT
04D4 E6   02       05750              LDB   2,X     OPERATOR
04D6 5A            05760              DECB            IT'S EASIER TO EVALUATE OPERATOR
          04D7     05770 OPLOP        EQU   *
04D7 A6   C4       05780              LDA   ,U      BYTE FROM SWAP
04D9 5D            05790              TSTB            OPERATOR IS:
04DA 2A   04       05800              BPL   NOCLR   NOT CLEAR
04DC A6   03       05810              LDA   3,X     ELSE LOAD CLEAR BYTE
04DE 20   0F       05820              BRA   OPOLO   TO COMMON EXECUTION
04E0 26   03       05830 NOCLR        BNE   NONOT   NOT A NOT OPERATION
04E2 43            05840              COMA            ELSE MAKE A NOT
04E3 20   0A       05850              BRA   OPOLO   AND GET NEXT BYTE
04E5 C1   01       05860 NONOT        CMPB  #1      IF 1 IS AND
04E7 26   04       05870              BNE   NOAND   ELSE IS AN OR
04E9 A4   03       05880              ANDA  3,X     AND WITH MASK
04EB 20   02       05890              BRA   OPOLO   AND CONTINUE
04ED AA   03       05900 NOAND        ORA   3,X     OR WITH MASK
          04EF     05910 OPOLO        EQU   *       HERE COME ALL OPTIONS
04EF A7   C0       05920              STA   ,U+     STORE NEW VALUE
04F1 31   3F       05930              LEAY  -1,Y    NUMBER OF BYTES REACHED?
04F3 26   E2       05940              BNE   OPLOP   NO, CONTINUE
04F5 35   46       05950              PULS  U,D     RESTORE ADDR. OF FFDT
04F7 1F   01       05960              TFR   D,X
04F9 6D   C8 02    05970              TST   <ORFLAG,U        MIXABLE?
04FC 27   16       05980              BEQ   OPADO   NO
04FE A6   C8 14    05990              LDA   <OWID,U
0501 A7   8D 049F  06000              STA   CADX,PCR
0505 A6   C8 0C    06010              LDA   <OLMASK,U        GET ORIG. LMASK
0508 E6   C8 0D    06020              LDB   <ORMASK,U        ORIG. RMASK
050B 6D   C9 0014  06030              TST   OWID,U
050F 26   16       06040              BNE   OPADOA
0511 5F            06050              CLRB
0512 20   13       06060              BRA   OPADOA
0514 A6   C8 0E    06070 OPADO        LDA   <WIDBYT,U
0517 A7   8D 0489  06080              STA   CADX,PCR
051B A6   C8 0A    06090              LDA   <LMASK,U
051E E6   C8 0B    06100              LDB   <RMASK,U
0521 6D   C8 0E    06110              TST   <WIDBYT,U
0524 26   01       06120              BNE   OPADOA
0526 5F            06130              CLRB
0527 43            06140 OPADOA       COMA
0528 A7   8D 0488  06150              STA   AUX2,PCR
052C 53            06160              COMB                INVERT IT
052D E7   8D 047E  06170              STB   AUX3,PCR
0531 17   02FD     06180              LBSR  NORMY   GET #ROWS IN FIG.
0534 1F   12       06190 OPAD1        TFR   X,Y
0536 E6   C8 0F    06200              LDB   <MAXBYT,U        MAX. WIDTH IN BYTES
0539 3A            06210              ABX
053A AF   8D 0472  06220              STX   AUX4,PCR
053E 1F   21       06230              TFR   Y,X     RESTORE ADDR. OF LEFT BYTE OF LINE
0540 A6   84       06240              LDA   ,X
0542 A4   8D 046E  06250              ANDA  AUX2,PCR
0546 A7   84       06260              STA   ,X
0548 E6   8D 0458  06270              LDB   CADX,PCR
054C 3A            06280              ABX             POINT TO RIGHTMOST BYTE
054D A6   84       06290              LDA   ,X      GET THE RIGHTMOST BYTE
054F A4   8D 045C  06300              ANDA  AUX3,PCR         ZEROES PROPAGATION
0553 A7   80       06310              STA   ,X+     AND PUT BACK
0555 AC   8D 0457  06320 OPAD2        CMPX  AUX4,PCR         ADDITIONAL BYTES TO CLEAR?
0559 24   04       06330              BHS   OPAD3   NO
055B 6F   80       06340              CLR   ,X+     CLEAR
055D 20   F6       06350              BRA   OPAD2
055F 6A   8D 0448  06360 OPAD3        DEC   ROWS,PCR         MORE ROWS TO ADJUST?
0563 26   CF       06370              BNE   OPAD1   YES
0565 A6   8D 043F  06380              LDA   ACTION,PCR
0569 81   04       06390              CMPA  #4
056B 1026 0421     06400              LBNE  EXIT
056F 4A            06410              DECA
0570 A7   8D 0434  06420              STA   ACTION,PCR
0574 A6   C8 08    06430              LDA   <AUTOX,U
0577 A7   8D 0429  06440              STA   CADX,PCR
057B A6   C8 09    06450              LDA   <AUTOY,U
057E A7   8D 0424  06460              STA   CADY,PCR
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0582 17    0003      06470          LBSR    MOVGEN
0585 16    0408      06480          LBRA    EXIT    NO, TERMINATE
                     06490 *-----------------------
                     06500 *SUBROUTINE TO MOVE AN OBJECT IN THE SCREEN
                     06510 *
           0588      06520 MOVGEN   EQU     *
0588 9E    BD        06530          LDX     <$BD    GET X COORD.
058A 109E  BF        06540          LDY     <$BF    GET Y COORD.
058D 0F    BD        06550          CLR     <$BD    CLEAR
058F 0F    BF        06560          CLR     <$BF    CLEAR
0591 34    30        06570          PSHS    X,Y
0593 A6    8D 040D   06580          LDA     CADX,PCR        GET COORD X OF DESTINATION
0597 E6    8D 040B   06590          LDB     CADY,PCR        GET COORD. Y OF DESTINATION
059B 17    008A      06600          LBSR    CONVER  GET ADDR. OF TOP CORNER
059E 34    02        06610          PSHS    A
05A0 A6    C8 0A     06620          LDA     <LMASK,U
05A3 6D    C8 0E     06630          TST     <WIDBYT,U
05A6 26    03        06640          BNE     SK0
05A8 A6    C8 0B     06650          LDA     <RMASK,U
05AB A7    8D 0400   06660 SK0      STA     AUX3,PCR
05AF 35    02        06670          PULS    A
05B1 10AE  8D 03F1   06680          LDY     ACTIO2,PCR
05B6 108C  0002      06690          CMPY    #2
05BA 26    0B        06700          BNE     SK1
05BC 34    16        06710          PSHS    X,A,B
05BE 17    013F      06720          LBSR    SWAP2   SWAP FROM BLOCK
05C1 35    16        06730          PULS    X,A,B   FIRST GET
05C3 108E  0000      06740          LDY     #0
           05C7      06750 SK1      EQU     *
05C7 AF    C8 06     06760          STX     <FIGCAD,U
05CA A7    C8 0A     06770          STA     <LMASK,U
05CD E7    C8 0B     06780          STB     <RMASK,U
05D0 E6    8D 03D8   06790          LDB     AUX,PCR NEW WIDTH
05D4 E7    C8 0E     06800          STB     <WIDBYT,U
05D7 C1    00        06810          CMPB    #0
05D9 26    03        06820          BNE     SKIP2
05DB A6    C8 0B     06830          LDA     <RMASK,U
05DE 108C  0001      06840 SKIP2    CMPY    #1
05E2 27    2A        06850          BEQ     RETGEN
05E4 1F    89        06860          TFR     A,B
05E6 4F              06870          CLRA
05E7 5D              06880          TSTB            SEE IF B=0
05E8 26    04        06890          BNE     COUNT1  NO
05EA 86    F8        06900          LDA     #-8
05EC 20    06        06910          BRA     DONE1   COUNT IS NOT NECESSARY
05EE 54              06920 COUNT1   LSRB            LOOP UNTIL
05EF 25    03        06930          BCS     DONE1   IT FINDS
05F1 4A              06940          DECA            FIRST 1
05F2 20    FA        06950          BRA     COUNT1
05F4 E6    8D 03B7   06960 DONE1    LDB     AUX3,PCR        GET OLD MASK
05F8 5D              06970          TSTB            SEE IF B=0
05F9 26    04        06980          BNE     COUNT2  NO
05FB 8B    08        06990          ADDA    #8
05FD 20    06        07000          BRA     DONE2
05FF 54              07010 COUNT2   LSRB            LOOP UNTIL
0600 25    03        07020          BCS     DONE2   IT FINDS
0602 4C              07030          INCA            FIRST 1
0603 20    FA        07040          BRA     COUNT2
           0605      07050 DONE2    EQU     *
0605 4D              07060          TSTA            IF NO SHIFT REQUIRED
0606 27    03        07070          BEQ     GOSWAP  GO TO SWAP
0608 17    01BE      07080          LBSR    SHIFT   GO TO SHIFT AS REQUIRED
060B 17    0080      07090 GOSWAP   LBSR    SWAP    PLACE FIGURE IN DEST.
060E 35    30        07100 RETGEN   PULS    X,Y     RESTORE
0610 6F    8D 039B   07110          CLR     AUX3,PCR
0614 A6    8D 038C   07120          LDA     CADX,PCR        NEW     X-COORD
0618 A7    C8 08     07130          STA     <AUTOX,U
061B A6    8D 0387   07140          LDA     CADY,PCR        NEW Y-COORD
061F A7    C8 09     07150          STA     <AUTOY,U
0622 9F    BD        07160          STX     <$BD    ORIGINAL COLUMN
0624 109F  BF        07170          STY     <$BF    AND ROW
0627 39              07180          RTS             RETURN
                     07190 *** SUBROUTINE TO GET ADDRESS OF AN SPECIFIC XY COORD.
                     07200 *** ENTRY: U= ADDRESS OF FIG. DESCRIPTOR BLOCK
                     07210 ***        A= X COORDINATE OF FIGURE
                     07220 ***        B= Y COORDINATE OF FIGURE
                     07230 *** EXIT:  X= ADDRESS OF UPER/LEFT CORNER
                     07240 ***        A= BITS MASK TO ADJUST LEFT BORDER
                     07250 ***        B= BITS MASK TO ADJUST RIGHT BORDER
                     07260 ***        AUX=WIDTH IN BYTES
0628 34    40        07270 CONVER   PSHS    U
062A 17    00BD      07280          LBSR    NORM    GET ADDRESS
062D 35    40        07290          PULS    U       RESTORE U
062F 5F              07300          CLRB    GET LEFT MASK
0630 8D    31        07310          BSR     SETBND
0632 34    02        07320          PSHS    A
0634 A6    8D 036C   07330          LDA     CADX,PCR        GET COLUMN
0638 AB    C8 04     07340          ADDA    <WIDTH,U        PLUS NUMBER OF COLS
063B 34    52        07350          PSHS    A,X,U
063D E6    8D 0365   07360          LDB     CADY,PCR        GET ROW
0641 17    00A6      07370          LBSR    NORM    GET ADDRESS OF RIGHT COL.
0644 1F    10        07380          TFR     X,D     PREPARE TO SUBTRACT
0646 A3    61        07390          SUBD    1,S     #FYTES BETWEEN RIGHT AND LEFT COLS
0648 35    52        07400          PULS    A,X,U   RESTORE
064A E7    8D 035E   07410          STB     AUX,PCR SAVE WIDTH IN BYTES
064E C6    01        07420          LDB     #1      PREPARE TO OBTAIN RIGHT MASK
0650 8D    11        07430          BSR     SETBND  GET RMASK
0652 6D    8D 0356   07440          TST     AUX,PCR IF WIDTH NO MORE THAN 1 BYTE
0656 26    08        07450          BNE     OUTCON
0658 EA    E4        07460          ORB     ,S      ONLY ONE MASK
065A 1F    98        07470          TFR     B,A
065C 35    04        07480          PULS    B
065E 20    02        07490          BRA     ENDCON
0660 35    02        07500 OUTCON   PULS    A       GET LEFT MASK
0662 39              07510 ENDCON   RTS
                     07520 ***HERE THE BYTE BOUNDARY IS ADJUSTED TO BIT BOUNDARY
           0663      07530 SETBND   EQU     *
0663 96    B6        07540          LDA     <$B6    GET PMODE
0665 84    01        07550          ANDA    #1      IF NOT PMODE 1 OR 3
0667 27    02        07560          BEQ     SET2    DO NOTHIMG
0669 08    BE        07570          LSL     <$BE    ELSE MULTIPLY END COL. BY 2
066B 96    BE        07580 SET2     LDA     <$BE    GET COLUMN
066D 84    07        07590          ANDA    #$07    NUMBER OF BITS
066F 31    8D 0013   07600          LEAY    >MASTAB,PCR     CONVERSION TABLE
0673 A6    A6        07610          LDA     A,Y     DISPLACEMENT
0675 5D              07620          TSTB            FLAG ON?
0676 26    01        07630          BNE     RISIDE  YES. RIGHT BORDER
0678 39              07640          RTS
           0679      07650 RISIDE   EQU     *
0679 4D              07660          TSTA            IF RMASK=FF
067A 26    06        07670          BNE     RI2     YES
067C 86    FF        07680          LDA     #$FF
067E 6A    8D 032A   07690          DEC     AUX,PCR WIDTH IS ONE BYTE LESS
0682 43              07700 RI2      COMA
0683 1F    89        07710          TFR     A,B
0685 39              07720          RTS
0686       00        07730 MASTAB   FCB     $00
0687       80        07740          FCB     $80
0688       C0        07750          FCB     $C0
0689       E0        07760          FCB     $E0
068A       F0        07770          FCB     $F0
068B       F8        07780          FCB     $F8
068C       FC        07790          FCB     $FC
068D       FE        07800          FCB     $FE
                     07810 * SWAP:
                     07820 *** MOVE A FIGURE FROM SCREEN TO A RESERVED AREA AND
                     07830 *** THE FIGURE FROM THE RESERVED AREA TO SCREEN
                     07840 * ON ENTRY: U= ADDRESS OF FDT
                     07850 * ON EXIT: SWAP PERFORMED
                     07860 * EXCEPT FOR U NO REGS ARE PRESERVED
           068E      07870 SWAP     EQU     *
068E 10AE  C8 00     07880          LDY     <ASW,U  ADDR. OF SWAP AREA
0692 AE    C8 06     07890          LDX     <FIGCAD,U       ADDRESS IN SCREEN
0695 17    0199      07900          LBSR    NORMY
0698 4F              07910 MORE1    CLRA
0699 E6    86        07920          LDB     A,X     FIRST BYTE FROM ROW
069B 34    04        07930          PSHS    B
069D E4    C8 0A     07940          ANDB    <LMASK,U        PREPARE IT TO MIX
06A0 EA    A6        07950          ORB     A,Y
06A2 20    06        07960          BRA     MORCOM  CONTINUE SWAPING ROW
06A4 E6    86        07970 MORE2    LDB     A,X     INTERMIDIATE ROW BYTE
06A6 34    04        07980          PSHS    B
06A8 E6    A6        07990          LDB     A,Y     BTE FROM SWAP
           06AA      08000 MORCOM   EQU     *
06AA 34    02        08010          PSHS    A
06AC 6D    C8 02     08020          TST     <ORFLAG,U       MIXABLE?
06AF 27    0F        08030          BEQ     NOOR    NO
06B1 96    B6        08040          LDA     <$B6    IS PMODE 1 OR 3?
06B3 84    01        08050          ANDA    #1
06B5 27    07        08060          BEQ     ORTWO   NO
06B7 A6    61        08070          LDA     1,S     BYTE FROM SCREEN
06B9 17    00CE      08080          LBSR    ORFIG   PERFORM "OR"
06BC 20    02        08090          BRA     NOOR    RESUME
06BE EA    61        08100 ORTWO    ORB     1,S     NORMAL OR OPERATION
06C0 35    02        08110 NOOR     PULS    A       RESTORE A
06C2 E7    86        08120          STB     A,X     STORE ON SCREEN
06C4 35    04        08130          PULS    B       GET BYTE FROM SCREEN
06C6 E7    A6        08140          STB     A,Y     STORE IT IN SWAP
06C8 4C              08150          INCA            A=A+1
06C9 A1    C8 0E     08160          CMPA    <WIDBYT,U       A=WIDTH IN BYTES?
06CC 22    0D        08170          BHI     ENDCOL
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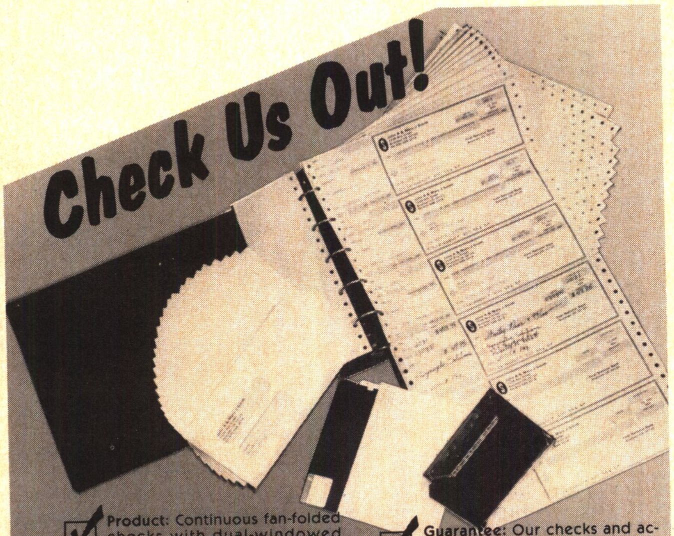

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06CE 25    D4         08180          BLO     MORE2
06D0 E6    86         08190          LDB     A,X      PROCESS .RIGHTMOST BYTE
06D2 34    04         08200          PSHS B
06D4 E4    C8 0B      08210          ANDB    <RMASK,U        MIX IT WITH BYTE FROM SWAP
06D7 EA    A6         08220          ORB     A,Y
06D9 20    CF         08230          BRA     MORCOM   TO NORMAL PROCESS
06DB D6    B9         08240 ENDCOL   LDB     <$B9     NUMBER OF BYTE FOR ROW
06DD 3A               08250          ABX              ADD TO X
06DE E6    C8 0F      08260          LDB     <MAXBYT,U       BYTES PER ROW
06E1 31    A5         08270          LEAY    B,Y      ADD TO Y
06E3 6A    8D 02C4    08280          DEC     ROWS,PCR        #ROWS-1
06E7 22    AF         08290          BHI     MORE1    IF NOT ZERO CONTINUE
06E9 39               08300          RTS
                      08310 *** NORMALIZE X,Y COORDINATES
                      08320 *** ON ENTRY: A=X COORD. B=Y COORD.
06EA 97    BE         08330 NORM     STA     <$BE     X-COORD.
06EC D7    C0         08340          STB     <$C0     Y-COORD.
06EE 96    B6         08350          LDA     <$B6     GET PMODE
06F0 81    04         08360          CMPA    #4       PMODE 4 OUT
06F2 27    08         08370          BEQ     ENNORM
06F4 04    BE         08380          LSR     <$BE     DIVIDE X BY 2
06F6 81    01         08390          CMPA    #1       PMODE >1
06F8 22    02         08400          BHI     ENNORM
06FA 04    C0         08410          LSR     <$C0     DIVIDE Y BY 2
06FC BD    9298       08420 ENNORM   JSR     $9298    TO ROM GET ADDRESS
06FF 39               08430          RTS
                      08440 * SWAP2:
                      08450 *** MOVE A FIGURE FROM SCREEN TO A RESERVED AREA AND
                      08460 *** THE FIGURE FROM THE RESERVED AREA TO SCREEN
                      08470 * DOES NOT CHECK FOR OR OPERATIONS. (FAST MODE)
                      08480 * ON ENTRY: U= ADDRESS OF FDT
                      08490 * ON EXIT: SWAP PERFORMED
                      08500 * EXCEPT FOR U NO REGS ARE PRESERVED
           0700       08510 SWAP2    EQU     *
0700 10AE  C8 00      08520          LDY     <ASW,U  ADDR. OF SWAP AREA
0704 AE    C8 06      08530          LDX     <FIGCAD,U       ADDRESS IN SCREEN
0707 17    0127       08540          LBSR    NORMY
070A 63    C8 0A      08550          COM     <LMASK,U
070D 63    C8 0B      08560          COM     <RMASK,U
0710 4F               08570 MORE21   CLRA
0711 E6    86         08580          LDB     A,X      FIRST BYTE FROM ROW
0713 E4    C8 0A      08590          ANDB    <LMASK,U        CUR BITS AT LEFT
0716 20    02         08600          BRA     MORCO2   CONTINUE SWAPING ROW
0718 E6    86         08610 MORE20   LDB     A,X      INTERMIDIATE ROW BYTE
071A 34    04         08620 MORCO2   PSHS    B
071C E6    8D 0288    08630          LDB     ACTION,PCR      CREATE FIG?
0720 C1    01         08640          CMPB    #1       YES
0722 27    04         08650          BEQ     COMX
0724 E6    A6         08660          LDB     A,Y      GET BYTE IN SWAP
0726 E7    86         08670          STB     A,X      PUT IN SCREEN
0728 35    04         08680 COMX     PULS    B
072A E7    A6         08690          STB     A,Y      SAVE IN SWAP
072C 4C               08700          INCA             A=A+1
072D A1    C8 0E      08710          CMPA    <WIDBYT,U       A=WIDTH IN BYTES?
0730 22    09         08720          BHI     ENDCO2
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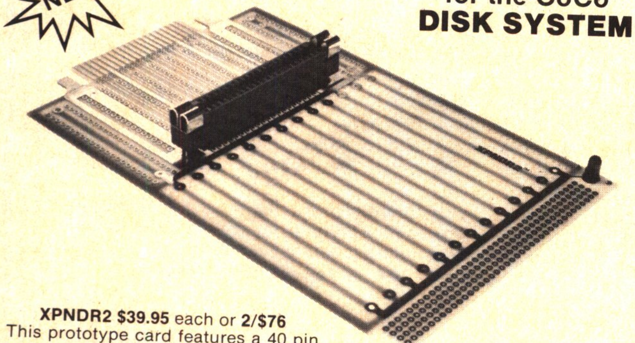
```
0732 25    E4         08730          BLO     MORE20
0734 E6    86         08740          LDB     A,X      PROCESS RIGHTMOST BYTE
0736 E4    C8 0B      08750          ANDB    <RMASK,U        MIX IT WITH BYTE FROM SWAP
0739 20    DF         08760          BRA     MORCO2   TO NORMAL PROCESS
073B D6    B9         08770 ENDCO2   LDB     <$B9     NUMBER OF BYTE FOR ROW
073D 30    85         08780          LEAX    B,X      ADD TO X
073F E6    C8 0F      08790          LDB     <MAXBYT,U       BYTES PER ROW
0742 31    A5         08800          LEAY    B,Y      ADD TO Y
0744 6A    8D 0263    08810          DEC     ROWS,PCR        #ROWS-1
0748 22    C6         08820          BHI     MORE21   IF NOT ZERO CONTINUE
074A 63    C8 0A      08830          COM     <LMASK,U
074D 63    C8 0B      08840          COM     <RMASK,U
0750 6D    C8 02      08850          TST     <ORFLAG,U       OR-ABLE?
0753 27    34         08860          BEQ     ENSWX    ...NO GET OUT
0755 AE    C8 02      08870          LDX     <ORFLAG,U
0758 A6    8D 024C    08880          LDA     ACTION,PCR      CREATE FIGURE?
075C 81    01         08890          CMPA    #1       IF YES GET-OUT
075E 27    10         08900          BEQ     ENSW2
0760 A6    C8 0C      08910          LDA     <OLMASK,U       RESTORE ORIG. LMASK
0763 6D    C9 0014    08920          TST     OWID,U
0767 26    03         08930          BNE     NORK
0769 A6    C8 0D      08940          LDA     <ORMASK,U
076C A7    8D 023F    08950 NORK     STA     AUX3,PCR
           0770       08960 ENSW2    EQU     *
0770 10AE  C9 0012    08970          LDY     FIGBYT,U
0775 34    40         08980          PSHS    U
0777 EE    C8 00      08990          LDU     <ASW,U  GET TO-ADDRESS
077A A6    8D 022A    09000          LDA     ACTION,PCR      CURRENT OPTION
077E 81    01         09010          CMPA    #1       IF NOT CREATE
0780 26    02         09020          BNE     ENSW3    GO AHEAD
0782 1E    31         09030          EXG     U,X      ELSE COPY FROM FIRST AREA TO SECOND
0784 17    0141       09040 ENSW3    LBSR    COPYSW   COPY AREAS
0787 35    40         09050          PULS    U        RESTORE U
           0789       09060 ENSWX    EQU     *
0789 39               09070          RTS
                      09080 * ORFIG. DETERMINES IF PIECE OF FIGURE ON
                      09090 * SCREEN SHOULD BE LEFT
                      09100 * ON ENTRY: A= BYTE FROM SCREEN
                      09110 *           B= BYTE FROM SWAP
                      09120 *           U= ADDR. OF FDT
                      09130 * ON EXIT:  B= ADJUSTED SWAP BYTE
                      09140 * REGS A AND B ARE NOT PRESERVED
           078A       09150 ORFIG    EQU     *
078A 34    06         09160          PSHS    A,B
078C 86    C0         09170          LDA     #$C0     FIRST TWO BITS TO CHECK
078E 6F    8D 0217    09180          CLR     RESB,PCR        CLEAR RESULT BYTE
0792 A7    8D 0214    09190          STA     BITAN,PCR
0796 A6    61         09200 OR1      LDA     1,S      GET BYTE FROM SWAP
0798 A4    8D 020E    09210          ANDA    BITAN,PCR       SUPRESS UNWANTED BITS
079C E6    8D 0212    09220          LDB     BKCOLO,PCR      GET COLOR TO BE 'ORED'
07A0 E4    8D 0206    09230          ANDB    BITAN,PCR       REMOVE UNWANTED BITS
07A4 34    04         09240          PSHS    B
07A6 A1    E0         09250          CMPA    ,S+      BAKGROUND COLOR IN SWAP?
07A8 26    06         09260          BNE     OR2      NO
07AA A6    E4         09270          LDA     ,S       GET BYTE FROM SCREEN
07AC A4    8D 01FA    09280          ANDA    BITAN,PCR       SUPRESS UNWANTED BITS
```

NEW

XPNDR2™
for the CoCo
DISK SYSTEM



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This prototype card features a 40 pin connector for projects requiring an on-line disk system or ROM paks. The CoCo signals are brought out to wire-wrap pins. Special gold plated spring clips provide reliable and noisefree disk operation plus solid support for vertical mounting of the controller. The entire 4.3×7 inch card is drilled for ICs. Assembled, tested and ready to run.

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Here is a unique plastic insert that aligns and supports printed circuit cards in the CoCo cartridge port. Don't forget to **ORDER ONE FOR YOUR XPNDR CARDS**.

Included with each XPNDR card are 8 pages of APPLICATION NOTES to help you learn about chips and how to connect them to your CoCo.

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Color Disk Manager will do selective initializations, verifies, backups, repairs and much more!

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- allows you to make a backup of the directory out of reach of basic and put it back if a directory crash occurs; has a recover file command which will load entire files off the disk if the directory crashes and the allocation table is good; will repair or salvage crashed disk several ways
- is 64K compatible allowing a 64K backup; does backups by track, a range of tracks, or the whole disk (will do more than 35 tracks)
- gives an allocation table map with granules x-referenced to tracks and sectors, and showing which granules are used; displays a file granule map showing which granules, tracks, and sectors the file uses, and the length
- will do a directory displaying file names in two columns, the number of free granules, and the free bytes if below 65535; has a kill file command
- loads and saves, sectors, tracks or files; loads files two ways, as done by basic, or with header bytes left in, which helps in studying how files are saved on disk; has an append sector command
- verifies tracks or the entire disk showing the track and sector if an error occurs, with the option of continue or stop
- is multiple drive compatible
- allows you to save a block of memory to disk; transfers programs from tape to disk
- has a rapid scan feature which allows you to scan the disk by tracks and sectors using the arrow keys
- will dump memory to the screen in ascii, good for listing basic programs or source files; has a move memory block command, and a transfer control command
- converts decimal to hex or hex to decimal
- allows you to examine memory using the arrow keys with displays in hex (or decimal) and ascii
- will load and execute rompac's saved on disk; has a move rom to ram command
- allows you to change origin (start addr.) of ML programs; displays the start, end, and execute addresses of ML programs
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- Add these features to your computer/program: ML extension of Basic loads on top of 16, 32, or 64K machines to enable easy mixture of **hi-res graphics and text** in your programs. Dense text or large lettering for children, visually impaired or VCR title screens with no programming!
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- 2 distinct character sets automatically switch for sharpest lettering featuring **underline, subscript, superscript, reverse video, top and bottom scroll protect, double width, colored characters in PMODE 4, and help screen.**
- Simple 2-letter abbreviated commands inside your program or **control key** entry from keyboard, even during program execution!
- Includes demo program, **character generator** program and manual. 16K Basic required — 32K recommended. **$29.95 Tape; $32.95 Disk.**

COLOR TAPE MANAGER

- merges multiple basic programs into one; appends multiple machine language programs into one; appends machine language to basic (example included)
- converts numbers from hex to decimal or decimal to hex; allows input in hex or decimal
- rapidly scans memory using the arrow keys with auto-key repeat
- displays memory in hex (or decimal) and ascii; allows the changing of memory in decimal or hex
- deals with missing end of file blocks; loads and saves data with or without a filename block
- handles programs with varying block lengths
- displays the start, end, and execute addresses of ML programs; displays the buffer start, end and top addresses
- converts ML programs into basic data statements which can be loaded as, or merged with, a basic program
- turns the audio and cassette motor on and off with one key commands; has inverted displays which lessen eye fatigue
- finds the end of programs on tape even from within a program with a skip file command; allows the transferring of control to other programs with a go command
- moves blocks of memory from start through end address to new start address; allows the changing of the origin (start adds) or ML programs
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Screen Machine can be used to directly create video recorder title screens or large lettering for children or the visually impaired simply by typing.

Dealer and author inquiries are always welcome. Canadian dealers should contact Kelly Software Distributors, Ltd., P.O. Box 11932, Edmonton, Alberta T5J-3L1, (403) 421-8003.

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- Track 20 individual player stats
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- Summarize 10 goalie stats
- Track 19 opposing team stats

Baseball will provide:

- Mid-season entry, update and additions
- Correct and review all stats in file
- Correction on all input screens
- Raw dump of data to the printer — for the player, pitcher, and opposing team's files
- Summary of the player, pitcher and opposing team's stats
- Track 21 individual player stats with 18 cum stats per player
- Track 15 individual pitcher stats with 11 cum totals per pitcher
- Compile total team summary of 16 separate stats
- Compile total pitching summary of 11 stats
- Track 15 opposing team stats with 14 cummed stats

Football will provide:

- Mid-season entry, update and additions
- Correct and review all stats in file
- Correction on all input screens
- Raw dump of data to the printer — for the player and opposing team's files
- Summary of the player and opposing team's stats
- Track 90 individual player stats
- Summarizes 63 individual cum stats per player
- Summarize 17 cum team stats
- Summarize 28 cum opposing team stats
- Team summaries of 87 stats
- Comparative summary printouts 63 stats for your team
- Comparative summary printouts 62 stats for opposing team
- Over 350 possible stats!

Basketball will provide:

- Mid-season entry, update and additions
- Correct and review all stats in file
- Correction on all input screens
- Raw dump of data to the printer — for the player and opposing team's files
- Summary of the player and opposing team's stats
- Track 22 individual player stats with 18 cum stats per player
- Summarizes 17 individual player team stats
- Compile opposing team summary of 19 separate stats

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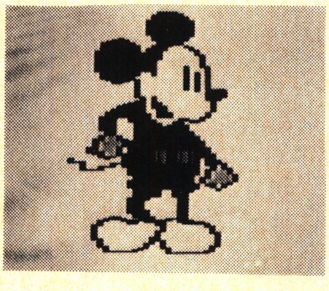

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07B0 AA   8D 01F5  09290 OR2     ORA     RESB,PCR         PUT SELECTED COLOR
07B4 A7   8D 01F1  09300         STA     RESB,PCR
07B8 64   8D 01EE  09310         LSR     BITAN,PCR        ANALIZE NEXT TWO BITS
07BC 64   8D 01EA  09320         LSR     BITAN,PCR
07C0 26   D4       09330         BNE     OR1     NOT FINISHED YET?
07C2 32   62       09340         LEAS    2,S     ADJUST STACK
07C4 E6   8D 01E1  09350         LDB     RESB,PCR         BYTE TO PUT IN SCREEN
07C8 39            09360         RTS
                   09370 * SHIFT. SUBROUTINE TO SHIFT A MATRIX AN SPECIFIED
                   09380 * NUMBER OF BITS
                   09390 * ON ENTRY:
                   09400 *           U= ADDRESS OF FIG. DESC. TABLE
                   09410 *           A=#BITS TO SHIFT.
                   09420 *             IF A<0 SHIFT LEFT
                   09430 *             IF A>0 SHIFT RIGHT
                   09440 * ON EXIT:  THE SWAP AREA FOR FIGURE IS SHIFTED.
                   09450 *           EXCEPT FOR U, NO REGISTERS ARE PRESERVED
          07C9     09460 SHIFT   EQU     *
                   09470 *PUT #BITS TO SHIFT IN X
07C9 1F   89       09480         TFR     A,B
07CB 4D            09490         TSTA
07CC 2A   01       09500         BPL     POSIT
07CE 50            09510         NEGB
          07CF     09520 POSIT   EQU     *
07CF 34   02       09530         PSHS    A
07D1 4F            09540         CLRA
07D2 1F   01       09550         TFR     D,X     PUT IN X
07D4 17   005A     09560         LBSR    NORMY   TO NORMALIZE Y
07D7 35   02       09570         PULS    A
07D9 10AE C8 00    09580         LDY     <ASW,U
07DD 34   30       09590         PSHS    X,Y
07DF E6   C8 0F    09600 SHO     LDB     <MAXBYT,U
07E2 10AE 62       09610         LDY     2,S
07E5 4D            09620 SHOB    TSTA    SHIFT RIGHT?
07E6 2B   09       09630         BMI     SH2A    NO, LEFT
07E8 1C   FE       09640         ANDCC   #$FE
07EA 66   A0       09650 SH1     ROR     ,Y+
07EC 5A            09660         DECB
07ED 26   FB       09670         BNE     SH1
07EF 20   09       09680         BRA     NEXTST
07F1 31   A5       09690 SH2A    LEAY    B,Y
07F3 1C   FE       09700         ANDCC   #$FE
07F5 69   A2       09710 SH2B    ROL     ,-Y
07F7 5A            09720         DECB
07F8 26   FB       09730         BNE     SH2B
07FA 30   1F       09740 NEXTST  LEAX    -1,X    MORE BITS TO SHIFT?
07FC 26   E1       09750         BNE     SHO     YES
07FE 6A   8D 01A9  09760         DEC     ROWS,PCR         MORE ROWS?
0802 27   0F       09770         BEQ     ENSHIF  NO
0804 E6   C8 0F    09780         LDB     <MAXBYT,U        ADJUST TO FIRST COL.
0807 10AE 62       09790         LDY     2,S
080A 31   A5       09800         LEAY    B,Y
080C 10AF 62       09810         STY     2,S
080F AE   E4       09820         LDX     ,S
0811 20   D2       09830         BRA     SHOB
0813 35   B0       09840 ENSHIF  PULS    Y,X,PC
                   09850 * CALCULATES MAXIMUM NUMBER OF BYTES PER ROW
                   09860 * FOR A FIGURE.
                   09870 * ON ENTRY: U= ADDRESS OF FIGURE DESCRIPTOR TABLE
                   09880 *           B= WIDTH IN PIXELS
                   09890 * ON EXIT:  MAXBYT WITH VALUE
                   09900 * U,X,Y ARE PRESERVED
          0815     09910 CMAXBY  EQU     *
0815 96   B6       09920         LDA     <$B6    GET PMODE
0817 81   04       09930         CMPA    #4      IS PMODE 4?
0819 27   05       09940         BEQ     CMAX1   YES
081B 84   01       09950         ANDA    #1      IF PMODE 1 OR 3
081D 26   01       09960         BNE     CMAX1   DO NOTHING
081F 54            09970         LSRB            NO, DIVIDE BY 2
          0820     09980 CMAX1   EQU     *
0820 1F   98       09990         TFR     B,A     SAVE TO OBTAIN
0822 84   07       10000         ANDA    #$07    REMAINDER OF D/8
0824 54            10010         LSRB            DIVIDE BY 8
0825 54            10020         LSRB
0826 54            10030         LSRB
0827 5C            10040         INCB            ADD 1 TO THE RESULT
0828 81   02       10050         CMPA    #2      IF REMAINDER<2
082A 2D   01       10060         BLT     CMAX2   GO OUT
082C 5C            10070         INCB            IF NOT ADD 1 OF RESULT
082D E7   C8 0F    10080 CMAX2   STB     <MAXBYT,U
0830 39            10090         RTS
                   10100 * FIND REQUIRED NUMBER OF
                   10110 * BYTES FOR A GIVEN NUMBER
                   10120 * OF ROWS.
                   10130 * ON ENTRY: U= ADDR, OF FDT
                   10140 * ON EXIT: A AND ROWS WITH VALUE
                   10150 * EXCEPT FOR A ALL REGS. ARE PRESERVED
0831 A6   C8 05    10160 NORMY   LDA     <HEIGHT,U        GET ROWS
0834 A7   8D 0173  10170         STA     ROWS,PCR
0838 96   B6       10180         LDA     <$B6    GET PMODE
083A 81   01       10190         CMPA    #1      NORMALIZE?
083C 22   04       10200         BHI     RETNY   NO
083E 64   8D 0169  10210         LSR     ROWS,PCR         YES, DIVIDE
0842 A6   8D 0165  10220 RETNY   LDA     ROWS,PCR
0846 39            10230         RTS
                   10240 * GET ADDRESS OF FIGURE
                   10250 * DESCRIPTOR TABLE (FDT)
                   10260 * ON ENTRY: X= ADDR. OF PARMLIST
                   10270 * ON EXIT: U=ADDR. OF FDT
                   10280 * X AND Y ARE PRESERVED
          0847     10290 GETFDT  EQU     *
0847 86   AA       10300         LDA     #$AA    SYSTEM INITIALIZED?
0849 A1   8D 01DF  10310         CMPA    2+FCTAB,PCR
084D 27   05       10320         BEQ     GE2     YES, OK
084F C6   07       10330         LDB     #XNI    ELSE ERROR
0851 16   00D9     10340         LBRA    ERROR
0854 33   8D 01D8  10350 GE2     LEAU    FFDT,PCR         ADDR. OF FIRST FDT
0858 34   40       10360         PSHS    U
085A A6   01       10370         LDA     1,X     FIGURE NUMBER
085C 27   06       10380         BEQ     GE3     FIGURE CAN'T BE ZERO
085E A1   8D 01C8  10390         CMPA    FCTAB,PCR        EXCEEDS MAX. NBR. OF FIG
0862 23   05       10400         BLS     GE4     NO, OK
0864 C6   02       10410 GE3     LDB     #XOF    ELSE ERROR
0866 16   00C4     10420         LBRA    ERROR
0869 A1   8D 01BE  10430 GE4     CMPA    1+FCTAB,PCR      GREATER THAN CREATED FIGS
086D 23   05       10440         BLS     GE5     NO, OK
086F C6   06       10450         LDB     #XNC    ELSE ERROR
0871 16   00B9     10460         LBRA    ERROR
0874 C6   18       10470 GE5     LDB     #24     SIZE IN BYTES OF A FDT
0876 4A            10480         DECA            TO OFFSET
0877 3D            10490         MUL             DISPLACEMENT
0878 E3   E1       10500         ADDD    ,S++    REAL ADDRESS
087A 1F   03       10510         TFR     D,U     LEAVE IN U
087C 39            10520         RTS
                   10530 * RANDOM. FIND A RANDOM NUMBER
                   10540 * ON ENTRY: A= MAX. VALUE OF NUMBER TO GENERATE
                   10550 * ON EXIT: B=RANDOM NUMBER. ALL REGS. PRESERVED BUT B
          087D     10560 RANDOM  EQU     *
087D 34   02       10570         PSHS    A       SAVE MAX. VALUE OF RANDOM NUMBER
087F 6D   8D 0134  10580         TST     PERIOD,PCR       SEQUENCE EXHAUSTED?
0883 26   07       10590         BNE     RA2     NO
0885 FC   0112     10600         LDD     $112    GET VALUE OF TIMER
0888 ED   8D 0129  10610         STD     SEED,PCR         AND USE IT AS NEW SEED
          088C     10620 RA2     EQU     *
088C EC   8D 0125  10630         LDD     SEED,PCR         GET SEED NUMBER
0890 34   06       10640         PSHS    D
0892 86   02       10650         LDA     #2      WILL MULTIPLY SEED BY 4
0894 68   8D 011E  10660 RA3     LSL     1+SEED,PCR       TWO TIMES 2
0898 69   8D 0119  10670         ROL     SEED,PCR
089C 4A            10680         DECA
089D 26   F5       10690         BNE     RA3     IF NOT DONE CONTINUE
089F 35   06       10700         PULS    D       GET OLD SEED
08A1 E3   8D 0110  10710         ADDD    SEED,PCR         THUS: OLD SEED BY 5
08A5 C3   0035     10720         ADDD    #53     PLUS 53
08A8 ED   8D 0109  10730         STD     SEED,PCR         NEW SEED
08AC C6   FF       10740         LDB     #$FF    MASK TO REDUCE RANDOM
08AE E7   8D 0102  10750         STB     AUX2,PCR
08B2 A1   E4       10760 RMAX    CMPA    ,S      IS NUMBER LESS OR EQUAL THAN MAX?
08B4 23   0A       10770         BLS     ENRA    YES, GET OUT
08B6 64   8D 00FA  10780         LSR     AUX2,PCR         GET RID OF LEFT BIT
08BA A4   8D 00F6  10790         ANDA    AUX2,PCR
08BE 20   F2       10800         BRA     RMAX    AND COMPARE AGAIN
          08C0     10810 ENRA    EQU     *       NUMBER FOUND
08C0 1F   89       10820         TFR     A,B     LEAVE IN B
08C2 6C   8D 00F1  10830         INC     PERIOD,PCR       PERIOD COUNTER
08C6 35   82       10840         PULS    A,PC    ADJUST STACK AND RETURN
                   10850 * COPY ONE SWAP AREA INTO ANOTHER
                   10860 * ON ENTRY: X= ADDR. OF FROM AREA
                   10870 *           U= ADDR. OF TO AREA
                   10880 *           Y=# OF BYTES TO COPY
                   10890 * ON EXIT: AREA COPIED. ONLY A IS PRESERVED
          08C8     10900 COPYSW  EQU     *
08C8 E6   80       10910         LDB     ,X+     GET BYTE
08CA E7   C0       10920         STB     ,U+     STORE IN TO-AREA
08CC 31   3F       10930         LEAY    -1,Y    DECREMENT COUNTER
08CE 26   F8       10940         BNE     COPYSW  MORE TO COPY?
08D0 39            10950         RTS
                   10960 * VERIFY IF ACTION ON OUT
                   10970 * OF SCREEN IS REQUIRED
                   10980 * ON ENTRY: Y= ADDR. OF VALUE FOR X/Y
                   10990 *           FLG WITH 0 FOR X OR 64 FOR Y
```

One-Liner Contest Winner . . .

This program takes machine code and automatically puts it into BASIC DATA statements. Just load the machine language code, RUN the program, set up a blank cassette to record and input the start and end addresses of the code. When you CLOAD the resulting tape, your DATA lines are all complete.

The listing:

```
10 CLS:PRINT"RECORDER ON?":INPUT
"START";B:INPUT"END";E:OPEN"O",#
-1,"DATA":Q=10:FORK=B TO E STEP8
:Q=Q+10:A$=STR$(Q)+" DATA ":FORJ
=0TO7:X$=STR$(PEEK(J+K))::A$=A$+
RIGHT$(X$,LEN(X$)-1)+",":NEXTJ:P
RINT#-1,LEFT$(A$,LEN(A$)-1):NEXT
K:CLOSE#-1:STOP
```

Dan Tandberg, M.D.
Albuquerque, NM

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Adventures* and its companion *Rainbow Adventure Tape*.)

```
                11000 * ON EXIT: CACX/CACY WITH X/Y DESTINATIONS
                11010 * EXCEPT FOR D ALL REGISTERS ARE PRESERVED
          08D1  11020 ACTOSC  EQU     *
08D1 6D   8D 00D9 11030       TST     1+FLG,PCR       TESTING X-COORD?
08D5 27   05    11040         BEQ     L0
08D7 E6   C8 05 11050         LDB     <HEIGHT,U       GET VERTICAL SIZE
08DA 20   03    11060         BRA     L1
08DC E6   C8 04 11070 L0      LDB     <WIDTH,U        GET HORIZONTAL SIZE
08DF E7   8D 00D1 11080 L1    STB     AUX2,PCR
08E3 EC   A4    11090         LDD     ,Y      GET X/Y VALUE
08E5 4D         11100         TSTA            NEGATIVE?
08E6 2D   0F    11110         BLT     L1B
08E8 E3   8D 00C1 11120       ADDD    FLG,PCR ADD IT WITH FLAG (64 IF Y)
08EC E3   8D 00C3 11130       ADDD    AUX2H,PCR       ADD TO SUBTOTAL
08F0 4D         11140         TSTA            GREATER THAN 255?
08F1 27   2F    11150         BEQ     LXX     ...NO GET-OUT
08F3 C6   02    11160         LDB     #2
08F5 20   02    11170         BRA     L1A
08F7 C6   01    11180 L1B     LDB     #1
08F9 EA   8D 00BC 11190 L1A   ORB     1+STATUS,PCR
08FD E7   8D 00B8 11200       STB     1+STATUS,PCR
0901 E6   C8 10 11210         LDB     <OUTSCR,U       WHAT TO DO?
0904 27   1D    11220         BEQ     LERX    MARK ERROR
0906 C0   02    11230         SUBB    #2
0908 27   1E    11240         BEQ     LREX    REMOVE FIGURE
090A 4D         11250         TSTA            OUT-OF-SCREEN LEFT OR UP?
090B 2A   01    11260         BPL     L2      ...NO
090D 53         11270         COMB
090E 5D         11280 L2      TSTB            WHAT TO DO?
090F 2C   0D    11290         BGE     L4      ADJUST TO ZERO
0911 4F         11300         CLRA            FREEZE IN BORDER
0912 C6   FF    11310         LDB     #255
0914 E0   8D 0096 11320       SUBB    1+FLG,PCR       191 IF Y
0918 E0   8D 0098 11330       SUBB    AUX2,PCR
091C 20   02    11340         BRA     LPX     GET OUT
091E 4F         11350 L4      CLRA            ADJUST TO ZERO
091F 5F         11360         CLRB
0920 ED   A4    11370 LPX     STD     ,Y      STORE NEW DEST. COORD.
0922 39         11380 LXX     RTS             END ROUTINE
0923 C6   00    11390 LERX    LDB     #XOS    ERROR INDICATOR
0925 16   0005  11400         LBRA    ERROR
0928 32   62    11410 LREX    LEAS    2,S     ADJUST STACK
092A 16   FABE  11420         LBRA    REMOV2  TO REMOVE FIGURE
                11430 * ERROR. THIS ROUTINE WILL SIGNAL ERRORS AND EXIT
                11440 * ON ENTRY: B= CODE OF ERROR TO BE ISSUED
                11450 * ON EXIT: ERROR MESSAGE PLUS PROGRAM TERMINATION
          092D  11460 ERROR   EQU     *
092D 31   8D 0089 11470       LEAY    ERMASK,PCR      ADDR. OF PRINT MASK
0931 30   8D 00A7 11480       LEAX    ERMSGT,PCR      TABLE OF ERRORS
0935 58         11490         ASLB    MULTIPLY CODE BY 2
0936 3A         11500         ABX             OFFSET
0937 A6   80    11510         LDA     ,X+     GET FIRST CHAR OF ERROR TYPE
0939 A7   22    11520         STA     2,Y     ON MASK
093B A6   84    11530         LDA     ,X      SECOND CHAR
093D A7   23    11540         STA     3,Y
093F A6   8D 0065 11550       LDA     ACTION,PCR      ACTION
0943 8A   30    11560         ORA     #$30    TO ASCII FORMAT
0945 A7   A8 20 11570         STA     32,Y    PUT IN MASK
0948 4F         11580         CLRA
0949 E6   8D 00D6 11590       LDB     1+PARMS,PCR     FIGURE NUMBER
094D 31   A8 15 11600         LEAY    21,Y    POINT TO MASK AREA FOR FIG. NUMBR.
0950 C1   64    11610 ERRO1   CMPB    #100    HERE WE WILL CONVERT
0952 2D   05    11620         BLT     ERRO2   FIG. NMBR. TO ASCII
0954 C0   64    11630         SUBB    #100    NUMBER OF HUNDREDS
0956 4C         11640         INCA
0957 20   F7    11650         BRA     ERRO1
0959 8A   30    11660 ERRO2   ORA     #$30    HUNDREDS IN ASCII
095B A7   A0    11670         STA     ,Y+     PUT IN PRINT MASK
095D 4F         11680         CLRA
095E C1   0A    11690 ERRO2B  CMPB    #10     TENS
0960 2D   05    11700         BLT     ERRO3
0962 C0   0A    11710         SUBB    #10
0964 4C         11720         INCA
0965 20   F7    11730         BRA     ERRO2B
0967 8A   30    11740 ERRO3   ORA     #$30 TO ASCII
0969 A7   A0    11750         STA     ,Y+
096B CA   30    11760         ORB     #$30    AND UNITS IN ASCII TOO
096D E7   A4    11770         STB     ,Y
096F C6   21    11780         LDB     #33     NUMBER OF CHARS IN MASK
0971 31   8D 0045 11790       LEAY    ERMASK,PCR      TO BEGINING OF MASK
0975 A6   A0    11800 ERRPRI  LDA     ,Y+     GET CHAR FROM BYTE
0977 AD   9F A002 11810       JSR     [$A002] WRITE CHAR ON SCREEN
097B 5A         11820         DECB            DECREMENT COUNTER
097C 26   F7    11830         BNE     ERRPRI  PRINT MORE CHARS
097E 6C   8D 0036 11840       INC     STATUS,PCR      FLAG STATUS WITH ERROR
0982 6D   8D 00A9 11850       TST     5+FCTAB,PCR     IF CALLED FROM ASSEMBLER
0986 27   08    11860         BEQ     EXIT    USE NORMAL EXIT
0988 10EE 8D 0061 11870       LDS     SAVSTK,PCR      RESTORE STACK POINTER
098D 7E   B44A  11880         JMP     $B44A   MAKE A FC ERROR
                11890 *
0990 10EE 8D 0059 11900 EXIT  LDS     SAVSTK,PCR      RESTORE STACK ADDR.
0995 EC   8D 001F 11910       LDD     STATUS,PCR      TO PRESENT STATUS
0999 6D   8D 0092 11920       TST     5+FCTAB,PCR     IF CALLED FROM ASSEMBLER
099D 27   03    11930         BEQ     EXITA   GET-OUT
099F 7E   B4F4  11940         JMP     $B4F4   OTHERWISE RETURN TO BASIC
09A2 39         11950 EXITA   RTS
                11960 *** DATA REFERENCES
09A3      00    11970 CACX    FCB     0
09A4      00    11980 CADX    FCB     0       TOP-LEFT COLUMN DEST. CORNER
09A5      00    11990 CACY    FCB     0
09A6      00    12000 CADY    FCB     0       TOP-LEFT ROW    DEST. CORNER
09A7      00    12010 ACTIO2  FCB     0
09A8      00    12020 ACTION  FCB     0       CURRENT OPTION
09A9      00    12030 RESB    FCB     0
09AA      00    12040 BITAN   FCB     0
09AB      00    12050 ROWS    FCB     0
09AC      00    12060 AUX     FCB     0
09AD      0000  12070 FLG     FDB     0
09AF      00    12080 AUX3    FCB     0
09B0      0000  12090 AUX4    FDB     0
09B2      00    12100 BKCOLO  FCB     0
09B3      00    12110 AUX2H   FCB     0
09B4      00    12120 AUX2    FCB     0
09B5      0000  12130 SEED    FDB     0       SEED VALUE FOR RANDOM ROUTINE
09B7      00    12140 PERIOD  FCB     0       PERIOD COUNTER OF RANDOM SEQUENCE
09B8      0000  12150 STATUS  FDB     0       STATUS
09BA      0D    12160 ERMASK  FCB     $0D     SKIP LINE
09BB      58    12170         FCC     /X## ERROR /
09C5      4F    12180         FCC     /ON FIGURE ### /
09D3      41    12190         FCC     /ACTION #/
09DB      0D    12200         FCB     $0D     SKIP LINE
09DC      4F    12210 ERMSGT  FCC     /OSOMOFIOEXEYNCNIIC/
09EE      0000  12220 SAVSTK  FDB     0
09F0            12230 STACK   RMB     $32
          0000  12240 XOS     EQU     0       OUT OF SCREEN
          0001  12250 XOM     EQU     1       OUT OF MEMORY
          0002  12260 XOF     EQU     2       INVALID FIG. NUMBER
          0003  12270 XIO     EQU     3       INVALID OPTION
          0004  12280 XEX     EQU     4       EXCEEDS MAX. X PIXELS
          0005  12290 XEY     EQU     5       EXCEEDS MAX. Y PIXELS
          0006  12300 XNC     EQU     6       FIG. NOT CREATED
          0007  12310 XNI     EQU     7       ANIMATIC NOT INITIALIZED
          0008  12320 XIC     EQU     8       CAN'T COPY FIGS.
                12330 *
0A22            12340 PARMS   RMB     8
                12350 *
0A2A      0000  12360 FCTAB   FDB     0       FIGURES CONROL TABLE
0A2C      0000  12370         FDB     0
0A2E      0000  12380         FDB     0
          0000  12390 NFIGS   EQU     0
          0001  12400 ADFFDT  EQU     1
          0003  12410 NEXTSW  EQU     3
0A30            12420 FFDT    RMB     1       DISPLACEMENT TO FIRST FDT
          0000  12430 ASW     EQU     0       ADDR. OF KEEP AREA
          0002  12440 ORFLAG  EQU     2       MIX. FLAG/SWAP FOR MIX. FIGS
          0004  12450 WIDTH   EQU     4       WIDTH IN PIXELS
          0005  12460 HEIGHT  EQU     5       HEIGHT IN PIXELS
          0006  12470 FIGCAD  EQU     6       ADDR. OF FIG. ON SCREEN
          0008  12480 AUTOX   EQU     8       COLUMN POSITION ON SCREEN (PIXELS)
          0009  12490 AUTOY   EQU     9       ROW POSITION ON SCREEN (PIXELS)
          000A  12500 LMASK   EQU     10      MASK WITH VALID BITS OF LEFTMOST BYTE
          000B  12510 RMASK   EQU     11      MASK WITH VALID BITS OF RIGHTMOST BYTE
          000C  12520 OLMASK  EQU     12      ORIGINAL LMASK
          000D  12530 ORMASK  EQU     13      ORIGINAL RMASK
          000E  12540 WIDBYT  EQU     14      ACTUAL WIDHT IN BYTES-1
          000F  12550 MAXBYT  EQU     15      MAXIMUM POSSIBLE WIDTH IN BYTES
          0010  12560 OUTSCR  EQU     16      ACTION IF OUT OF SCREEN
          0011  12570 FLAGCR  EQU     17      FLAG FOR NEWLY CREATED FIG.
          0012  12580 FIGBYT  EQU     18      MAX NUMBER OF BYTES FOR FIGURE
          0014  12590 OWID    EQU     20      ORIG. WIDTH
                12600 * BYTES 21-23 RESERVED FOR FUTURE *
0A31      00    12610 ENDGRA  FCB     0
          0000  12620         END
00000 TOTAL ERRORS
```

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Send In The Clowns

By Daryl Judd

This simple program, called *The Clown,* represents an initial experiment with graphics by the author. His idea for *The Clown* was inspired on a cold day in an attempt to turn thoughts to fair weather. The program also plays a refrain from the well-known tune, "Send in the Clowns." It requires 16K ECB and uses regular BASIC program commands.

(Daryl Judd directs the news at KIVI-TV channel six in Nampa, Idaho. He works on his computer in his spare time.)

240	13
510	199
690	695
END	173

The listing: CLOWN

```
10 CLS:PCLEAR8
20 A$="L4CL4DL4GL1GP2":B$="L4AL4
BL4GL4AL4BL4BL2BP4"
30 C$="L4BO4L4DO3L4DL1EP4":D$="L
4EL4GL4CL1DP4"
40 E$="L4EL4EL4GL4CL1D":F$="P1L4
DL4EL4GL4G-L1G"
50 PRINT"the clown":PRINT@498,"B
Y DARYL JUDD";
60 FORX=1TO500:NEXTX
70 PMODE 3,1:PCLS:COLOR 2,2
80 REM*BALLOONS*
90 CIRCLE (50,50),20,2
100 PAINT(35,53),2,2
110 CIRCLE(50,50),21,3,1,0,.27
120 CIRCLE(70,70),20,3,1,.72,.49
130 PAINT(70,70),3,3
140 LINE(48,70)-(52,70),PSET
150 LINE(48,71)-(52,71),PSET
160 LINE(46,72)-(54,72),PSET
170 COLOR 3,3
180 LINE(50,70)-(50,180),PSET
190 LINE(69,90)-(71,90),PSET
200 LINE(68,91)-(72,91),PSET
210 LINE(66,92)-(74,92),PSET
```

```
220 LINE(70,90)-(70,190),PSET
230 CIRCLE(85,30),20,4
240 PAINT (85,32),4,4
250 COLOR 4,4
260 LINE(84,50)-(86,50),PSET
270 LINE(83,51)-(87,51),PSET
280 LINE(81,52)-(89,52),PSET
290 COLOR 3,3
300 LINE(85,50)-(85,184),PSET
310 SCREEN 1,0
320 PMODE 3,5
330 PCLS(2)
340 REM*DRAW HEAD*
350 CIRCLE (127,80),60,3,1,.5,0
360 COLOR 3,1
```

```
370 LINE (68,80)-(68,100),PSET
380 LINE (185,80)-(185,100),PSET
390 CIRCLE (68,133),65,3,.5,.2,.
75
400 CIRCLE (185,133),65,3,.5,.75
,.3
410 CIRCLE (129,100),74,3,1,.16,
.355
420 PAINT (127,21),1,3
430 REM*DRAW NOSE*
440 CIRCLE (130,110),15,2
450 PAINT (130,103),3,2
460 COLOR 1,1
470 CIRCLE(130,110),7,1,1,.45,.7
9
480 REM*DRAW LEFT EYE*
490 CIRCLE (106,80),15,2,2,.42,.
1
500 CIRCLE (106,70),25,2,1,.6,.7
9
510 CIRCLE (106,93),10,2,.5,.6,.
93
520 CIRCLE (96,80),15,2,1.2,.75,
.14
530 PAINT (97,81),2,2
540 LINE (99,70)-(99,80),PSET
550 CIRCLE (96,80),16,3,1.2,.77,
.1
560 REM*DRAW RIGHT EYE*
570 CIRCLE (150,80),15,2,2,.42,.
1
580 CIRCLE (150,70),25,2,1,.71,.
9
590 CIRCLE (150,93),10,2,.5,.6,.
93
600 CIRCLE (140,80),15,2,1.2,.75
,.14
610 PAINT (141,81),2,2
620 LINE (143,70)-(143,80),PSET
630 CIRCLE (140,80),16,3,1.2,.77
,.1
640 REM*DRAW MOUTH*
650 CIRCLE (126,77),74,2,1,.13,.
37
660 CIRCLE (129,65),74,3,1,.13,.
37
670 CIRCLE (129,95),74,3,.9,.1,.
4
680 CIRCLE (77,128),10,3,1,.4,.8
3
690 CIRCLE (183,126),10,3,1,.72,
.2
700 REM*DRAW HAIR*
710 CIRCLE (50,90),15,4
720 CIRCLE (199,90),15,4
730 CIRCLE (30,90),20,4
740 CIRCLE (218,90),20,4
750 CIRCLE (18,100),10,4
760 CIRCLE (232,100),10,4
770 CIRCLE (30,75),12,4,1.8
780 CIRCLE (220,75),12,4,1.8
790 CIRCLE (50,69),18,4
800 CIRCLE (201,69),18,4
810 CIRCLE (34,63),22,4
820 CIRCLE (213,63),22,4
830 CIRCLE (52,48),20,4,.6
840 CIRCLE (198,48),20,4,.6
850 CIRCLE (54,46),16,4
860 CIRCLE (195,46),16,4
870 CIRCLE (69,40),10,4
880 CIRCLE (180,40),10,4
890 CIRCLE (79,35),8,4
900 CIRCLE (174,35),8,4
910 CIRCLE (88,28),4,4
920 CIRCLE (162,29),4,4
930 X$="XA$;XA$;XB$;XC$;XD$;XE$;
"
940 PLAY X$
950 SCREEN 1,1:PLAY F$
960 GOTO 960
```

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String Functions:	CHR$, LEFT$, MID$, RIGHT$, LEN, INSTR, LSET, RSET, TRM$, STR$, STRING$, INKEY$, MKN$
Numeric Functions:	ABS, POS, TIMER, RND, ASC, TAB, CAL, JOYSTK, PEEK, POKE, LOC, LOF, EOF, FREE, CVN, ERR, VARPTR, SWAP
I/O Commands:	OPEN, CLOSE, INPUT, LINEINPUT, PRINT WRITE, PRINT @, GET, PUT, KILL, CHAINM, FIELD, DATA, READ, RESTORE
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Directives:	ORG, REM OR ', END, DIM, END, BASE, RAM, ON/OFF, RAM64K, HIRES, GENERATE, DPSET, STACK
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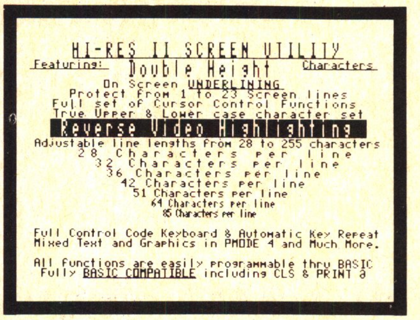

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       32  Characters  per  line
         36  Characters  per  line
           42  Characters  per  line
             51 Characters per line
               64 Characters per line
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Upper/Lower case characters	Yes	Yes	Yes
Mixed Text and Graphics	Yes	Yes	Yes
Separate Text & Graphics	Yes	Yes	No
Print @ fully implemented	Yes	Yes	Yes
Print @ on all line lengths	Yes	Yes	51 only
Different line lengths	28 to 255 (9)	28 to 255 (9)	51 only (1)
Automatic Key Repeat	Yes	Yes	Yes
Adjustable Key Repeat	Yes	No	No
Auto Repeat Disable	Yes	No	No
Erase to end of line/screen	Yes	Yes	Yes
Home Cursor	Yes	Yes	Yes
Solid or Blinking Cursor	Yes	No	Yes
CLS command supported	Buff/Biack	Buff/Black	Buff/Black
X,Y Coordinate Cursor Positioning	Yes	Yes	No
Double Size Characters	Yes	Yes	No
Individual/Continuous Highlighting	Yes	Yes	No
On Screen Underlining	Yes	Yes	No
Clear Key functional	Clear/L keys	Clear key	No
16.32 & 64K Supported	Yes	Yes	Yes
Green or Black Background Color	Yes	No	No
Dual Character sets for Enhanced 64 and 85 Characters per line display	Yes	No	No
Protected Screen Lines (programmable)	1 to 23	No	No
Full Control Code Keyboard for Screen control directly from the keyboard	Yes	No	No
Programmable Tab Character Spacing	Yes	No	No
Full Screen Reverse Function	Yes	Yes	No
Switch to & from the Standard 16 by 32 Screen for full compatability	Yes	No	No
On Error Goto Function	No	No	Yes
Extended Basic Required	No	Yes	Yes
All Machine Language Program	Yes	Yes	Yes
RAM Required in addition to Screen RAM	2K	2K	2K
Program Price (Tape)	$24.95	$19.95	$29.95

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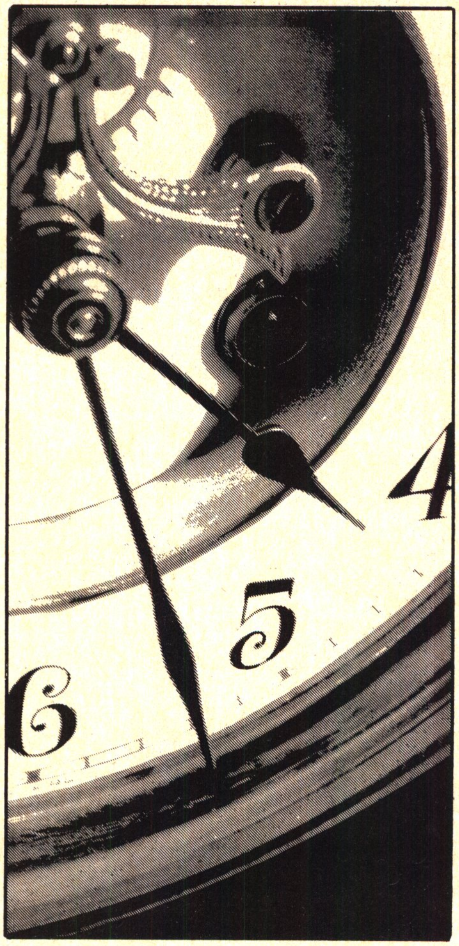
HARDWARE PROJECT

32K ECB

Make your computer a piece of precision machinery with these blueprints for adding a real-time clock



CoCo Chronograph

By Colin J. Stearman

"Time is money" so they say, and going by the cost of the commercial real-time clocks available for the CoCo, they must be right! A real-time clock is simply a clock chip similar to one in a digital watch which can be read by the computer to find out the "real" time, date and day of the week. The clock should run independently of the computer and continue to keep time when the computer is off. With this in mind, let's design and build a real-time clock for CoCo.

(Colin J. Stearman is an electronics engineer educated in the U.K. He has worked with all kinds of computers and has been a CoCo enthusiast for over three years.)

Design Goals

The clock should be out of sight inside CoCo so it does not use up a valuable cartridge slot. CoCo should charge the clock batteries while you're computing. Also, the clock chip should be inexpensive and accurate.

To meet these goals, the *CoCo Chronograph* will be installed inside CoCo and use the OKI MSM5832 clock/calendar chip. It meets all the requirements and I have seen it advertised for as little as $3.95! It is also very simple to interface as the schematic in Figure 1 shows. The block diagram for this chip is shown in Figure 2.

Construction

The object of the construction is to mount a new 6821 PIA (Peripheral Interface Adapter) inside the computer without making irreversible modifications to the circuit board. I did this by "piggybacking" the new PIA onto U4 in the gray CoCo (U7 in the CoCo 2). U4 (U7) is an existing PIA used to drive the D/A converter and control the VDG chip.

To construct the unit, first gather the components listed in Figure 1. JDR Microdevices (800-538-5000 or 800-995-5430 in California) is a good source for all the chips and transistors. Parts should run in the price range of $12-$15. By the time you add the board (Radio Shack #276-158 or similar) and the other miscellaneous resistors, capacitors and wire, the total cost should be under $25. (That satisfies goal #3!)

To assemble the parts, first remove the cover from CoCo and also the RF shield lid inside if yours has one. Locate U4 (U7 in CoCo 2) and the 6821 (6822 in CoCo 2). Gently pry the IC out of its socket using a small screwdriver or IC puller. Be careful not to damage the pins. Put CoCo to one side as we will now construct the piggyback board assembly.

Mount the 40-pin socket to the printed circuit board anywhere convenient, but remember it will be positioned directly over the PIA we just removed from CoCo and must not interfere with any nearby components. Also mount the socket toward the edge of the board to leave room for the other chips and components. Solder all pins on the socket to the PCB, but *do not* cut off the excess.

Take the new 6821 and gently bend pin 24 outward a little so when the IC is put into the socket, this pin will not enter it. Put the IC in the socket and press it home.

Mount the CD4011 along side the 6821 near pin 24. Solder all pins to the board. Using the hook-up wire, connect pins 7, 8, 9, 12 and 13 together, and also to pin 1 of the 40-pin socket. Connect pin 14 of the CD4011 to pin 20 on the 40-pin socket. Connect pins

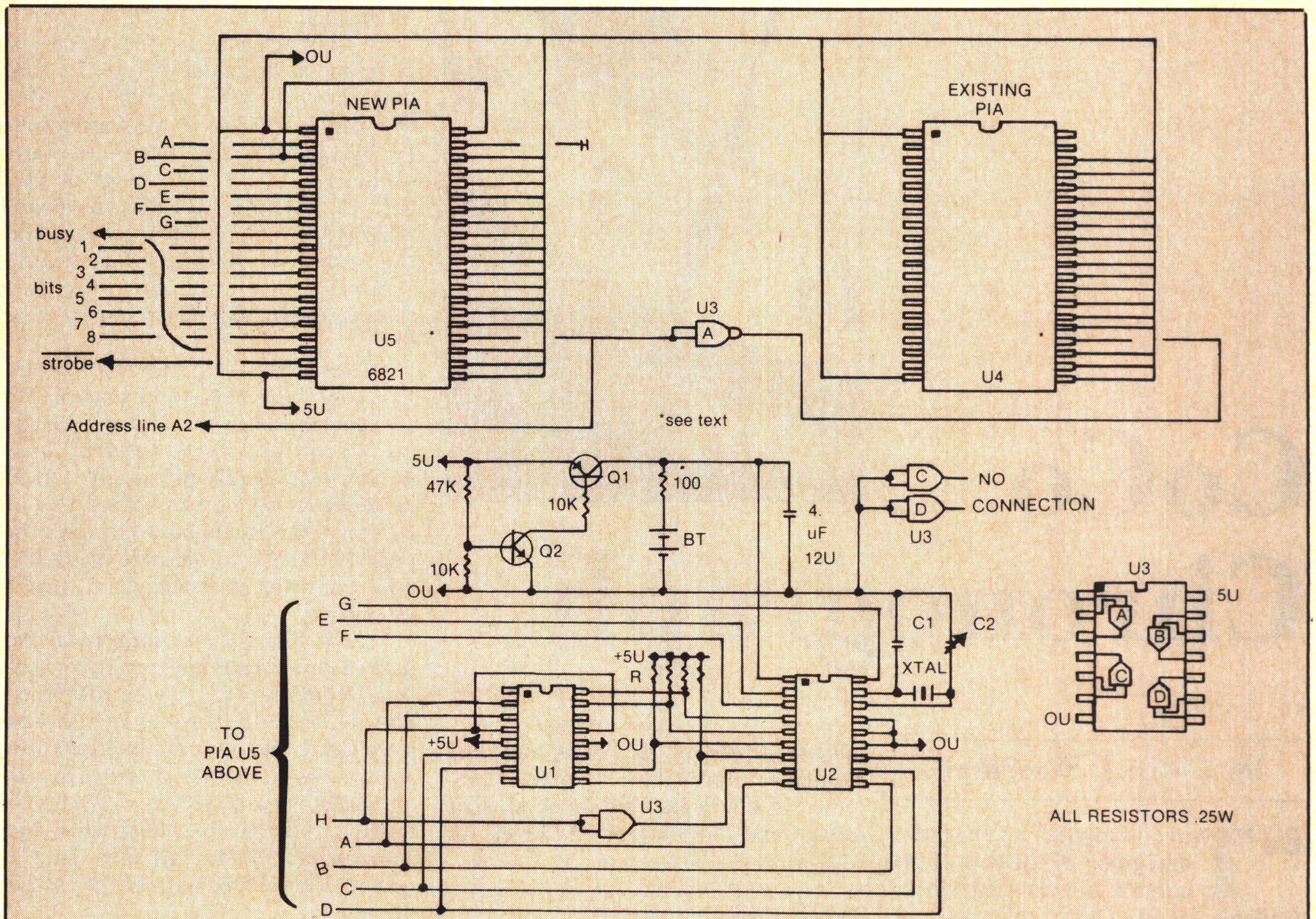
1 and 2 to pin 24 of the 6821. This is the bent pin not inserted into the socket. Also connect this pin to a length of wire about nine inches long; the other end will be connected later. Connect pin 3 of the CD4011 to pin 24 of the 40-pin socket.

Now mount the remainder of the components. The layout is not critical, but try to keep the crystal XT and the capacitors C1 and C2 close to pins 16 and 17 of the MSM5832. The batteries should not be mounted on the board. Use two AA size NiCads (Radio Shack #23-125) in a holder (Radio Shack #270-382). Connect to the holder with a battery snap (Radio Shack #270-325). The entire battery assembly can be mounted anywhere convenient in the case. (I put mine under the keyboard.)

Wire up the components as shown in Figure 1. All connections between the new PIA and the existing PIA are achieved later by the piggyback technique. Letters 'A' through 'H' show the connections between the clock circuit and the new PIA. Don't forget that connection between pin 3 and 40 on U5! All references to +5V can be picked up from pin 20 of U5. Similarly the 0V connections can be connected to pin 1 of U5.

When all wiring is complete, turn the PCB upside down and cut off the wire-wrap pins from pins 2 through 19, and pins 39 and 40 only. Cut them as close as possible to the board. The next task is to mount the assembly on top of the 6821 (6822) removed previously from CoCo.

Locate this PIA and carefully bend pin 24 so it points vertically upward. Position the circuit assembly on top of this IC to test for fit. It may be necessary to splay the wire-wrap pins out a little. In order for the finished assembly to fit under the RF shield lid if you have one, the remaining wire-wrap pins must be trimmed as short as possible. Gauge how much you can cut from each pin and then trim all to this height.

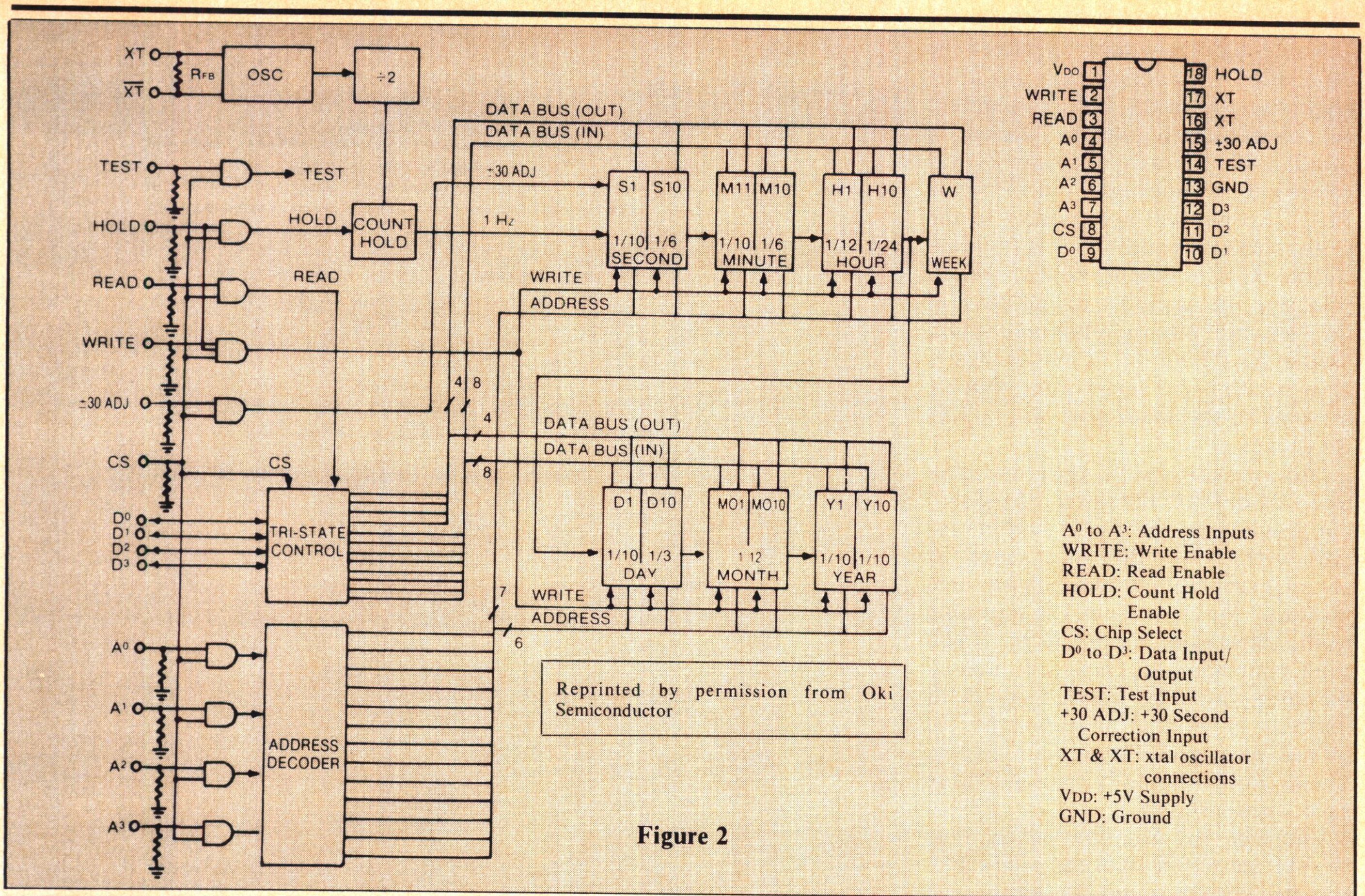


PARTS LIST

U1 — SN7475 QUAD D FLIPFLOP
U2 — MSM5832 OKI CLOCK CALENDAR
U3 — CD4011 CMOS QUAD NAMO GATE
U4 — EXISTING KEYBOARD PIA 6821
(6822 ON COCO 2)
U5 — 6821 PERIPHERAL INTERFACE
ADAPTER

R — 4 x 4 7K OHMS
XT — 32768 CRYSTAL (STATEK CX-IV -32.768)
C1 — 30 pF
C2 — 5 — 30 pF ADJUSTABLE
BT — 2 x 1.25v MiCd BATTERIES
Q1 — 2N3638 Vce (sat)=0.1V
Q2 — 2N2222

Figure 1: PARALLEL PORT AND REAL-TIME CLOCK


XT
XT
RFB
OSC
÷2
DATA BUS (OUT)
DATA BUS (IN)
TEST
TEST
±30 ADJ
HOLD
HOLD
COUNT HOLD
1 Hz
S1 S10 1/10 1/6 SECOND
M11 M10 1/10 1/6 MINUTE
H1 H10 1/12 1/24 HOUR
W WEEK
READ
READ
WRITE
WRITE
ADDRESS
±30 ADJ
4 8
CS
CS
D0 D1 D2 D3
TRI-STATE CONTROL
D1 D10 1/10 1/3 DAY
MO1 MO10 1 12 MONTH
Y1 Y10 1/10 1/10 YEAR
7
6
A0 A1 A2 A3
ADDRESS DECODER
VDD 1, WRITE 2, READ 3, A0 4, A1 5, A2 6, A3 7, CS 8, D0 9
18 HOLD, 17 XT, 16 XT, 15 ±30 ADJ, 14 TEST, 13 GND, 12 D3, 11 D2, 10 D1

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A0 to A3: Address Inputs
WRITE: Write Enable
READ: Read Enable
HOLD: Count Hold Enable
CS: Chip Select
D0 to D3: Data Input/Output
TEST: Test Input
+30 ADJ: +30 Second Correction Input
XT & XT: xtal oscillator connections
VDD: +5V Supply
GND: Ground

Figure 2

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Now solder the wire-wrap pins to the original PIA, soldering each pin to its respective pin on the PIA. You should be connecting to pins 1, 20 and 21 through 38. The wire-wrap pin 24 will connect to the up-turned pin 24 on the PIA. This pin will not connect to the CoCo socket when the PIA is returned to the CoCo motherboard. When soldering the assembly to the back of the PIA, minimize the amount of solder used so the IC will still fit into its socket. Also position the solder joint high on the pins so the lower part will still fit the socket.

Now mount the finished assembly into CoCo. Press the lower PIA gently but firmly into the CoCo socket. All pins of the lower PIA must enter the socket, except for pin 24 which was bent upwards. Make sure pin 1 is returning to the same place it came from. If you can't remember, all chips are oriented the same way in both style CoCos. It's not easy to see that all pins enter the socket, so inspect the results carefully. The assembly should be firm and quite rigid when installed.

The wire still left unattached must be soldered to pin 10 of the 6809 CPU. Cut this wire to a suitable length and attach it either directly to pin 10 of the 6809 or to a convenient solder point connected to this pin. You'll have to trace one out. Probably soldering lightly to the chip is best as the CPU can more easily be replaced than the board if things go wrong! This wire picks up address line 2 to allow the software to distinguish between the two PIAs.

If you followed my recent series, "Cooking with CoCo," you may notice something familiar about the circuit in Figure 1. In Part six of that series (December 1984 RAINBOW, Page 154), we constructed a parallel port by adding a new 6821 PIA chip. This had some unused ports and it is these which are used to access the real-time clock.

If you do not want the parallel port, simply make no connections to pins 9 through 19 of the U5 chip. If you do, then check the "Cooking with CoCo" article previously mentioned on how to drive the port. If you built the port then, you'll have to modify it to accommodate the real-time clock. (The SN7404 used in "Cooking with CoCo" *must* be replaced with a CD4011 and this does not have the same pinout. If you don't change it, the clock will not work! Also, you may need a larger board on which to mount the additional components.)

Listing 1: REALTIME

```
                   TTL   CoCo Chronograph
            ************************************************
            *          REAL TIME CLOCK PROGRAM             *
            *          C.J. STEARMAN (C) 1985              *
            ************************************************
            *
            *
            *   THIS ROUTINE IS CALLED FROM BASIC TO
            *   SET OR READ THE MSM5832 CLOCK.  THE
            *   CALL IS:
            *
            *   A=USR(VARPTR(A$))

            * IF A IS ZERO CALL WAS OK. NOT ZERO PROBABLY
            * MEANS A$ NOT AT LEAST 14 CHARACTERS LONG
            *
            *   WHERE A$ IS A 14 CHARACTER STRING AS FOLLOWS:
            *
            *   BYTE #      MEANING
            *      1        YEARS TENS
            *      2        YEARS UNITS
            *      3        MONTH TENS
            *      4        MONTH UNITS
            *      5        DAY TENS
            *      6        DAYS UNITS
            *      7        DAY OF THE WEEK
            *      8        HOURS TENS
            *      9        HOURS UNITS
            *     10        MINS TENS
            *     11        MINS UNITS
            *     12        SECONDS TENS
            *     13        SECONDS UNITS
            *     14        READ/WRITE FLAG
            *
            *   ALL VALUES ARE GIVEN AND RETURNED AS ASCII
            *   CHARACTERS.  THE CLOCK IS IN 24 HOUR FORMAT.
            *   THE READ/WRITE FLAG IS "0" TO READ THE CLOCK
            *   AND SET TO "1" TO WRITE THE CLOCK.
            *
            *   THE LEAP YEAR FLAG IS SET TO CAUSE FEBRUARY
            *   TO HAVE 29 DAYS IN A LEAP YEAR. THIS OCCURS
            *   WHENEVER THE THE CLOCK IS READ IN JANUARY
            *   OR FEBRUARY OF THE LEAP YEAR. THIS MAKES THE
            *   LEAP YEAR CORRECTION AUTOMATIC AND TRANSPARENT
            *   TO THE USER, ASSUMING THE CLOCK IS READ AT
            *   LEAST ONCE DURING JANUARY/FEBRUARY OF THE
            *   LEAP YEAR
            *
            *   A TYPICAL WRITE CALL TO SET THE DATE TO
            *   SEPTEMBER 19 1984 WEDNESDAY
            *   14:52 (SECONDS ARE NOT WRITTEN):
            *
            *   A$="84091941452001"
            *
            *   WHEN CALL IS MADE DATA IS WRITTEN AND SECONDS
            *   SET TO ZERO
            *
            *   TO READ THE CLOCK CALL WITH:
            *
            *   A$=STRING$(14,"0")
            *
            *   THE DATA IS RETURNED IN THE STRING IN THE
            *   SAME FORMAT AS ABOVE, INCLUDING SECONDS
            *
            *   EACH CALL LEAVES THE CLOCK SET UP WITH
            *   A0-A3 HIGH, READ HIGH, WRITE AND HOLD LOW, AND
            *   CS HIGH TO ENABLE THE 1 SECOND INTERRUPT
            *   THIS INTERRUPT COMES IN ON CA1 AT $FF25
            *
            ************************************************
            *
7E00                ORG   $7E00
7E00 8D47   PWRCLK BSR   TEST         VERIFY CALL
            **********
            *THIS ROUTINE READ/WRITES A BLOCK OF 13 BYTES
            *TO THE CLOCK. THE 14TH BYTE IS 0 TO READ
            *DATA AND 1 TO WRITE DATA. ALL VALUES ARE ASCII
            *REG X POINTS TO THE FIRST BYTE TO GO AT CLOCK
```

Double-Check

When all wiring and construction has been checked and double-checked, the assembly must be given the "smoke test." You may not be aware that all electronic components work by using smoke, but once the smoke gets out, they no longer work. How many chips have you had smoke come out of and they still work afterwards?

Turn CoCo on and watch for any smoke leaks! If the normal banner comes up and all the smoke stays in the chips, things are looking good. Use your meter to measure the voltage between an OV point and pin 1 of the MSM5832. It should be around 4.8 volts.

Also measure across the emitter and collector of TR1: this is the same as measuring between pin 1 of the MSM5832 and pin 20 of the new PIA. This voltage should be about 0.1V and not more than 0.2V. This is the VCE(sat) of TR1, or the voltage from collector to emitter when the transistor is saturated. If it's too high, the MSM5832 will have insufficient drive voltage. Try another 2N3638 if it is too high. Turn CoCo off and measure pin 1 of the MSM5832 against an OV point again. It should be around 2.5V if your batteries are charged.

Calibration

The crystal oscillator for the clock runs at 32.768kHz and is trimmed with C2. However, you cannot measure this frequency directly with either an oscilloscope or frequency meter because either one will load the oscillator and change the very thing you're trying to measure. If you do have access to either of these test instruments, you can measure the square wave on pin 9 of the MSM5832. It should have a period of 976.5625uS (micro-seconds) plus or minus 0.0015uS. Use C2 to set it exactly.

If you do not have such equipment, the only alternative method is to compare your *CoCo Chronograph* time with a quartz watch or other accurate clock and adjust over several days. The adjustment of C2 is not very sensitive, so make reasonable size adjustments each time. Remember that C2 is a capacitor without stops and the adjusting screw will revolve a full 360 degrees, so at one point the capacitance change will reverse direction for the same direction turn of the screw adjustment.

```
                   0079 *ADDRESS 0. SEE ABOVE FOR FORMAT
                   0080 *
7E02 C60C          0081         LDB   #12            BYTE COUNTER
7E04 A60D          0082         LDA   13,X         GET READ/WRITE FLAG
7E06 8030          0083         SUBA  #'0          ZERO IF READ/NOT IF WRITE
7E08 3402          0084         PSHS  A              SAVE FLAG
7E0A 6DE4          0085 NXTVAL  TST   ,S             CHECK READ/WRITE FLAG
7E0C 270C          0086         BEQ   CLK         BRANCH IF READING
7E0E A680          0087         LDA   ,X+         GET VALUE, WE'RE WRITING
7E10 8030          0088         SUBA  #'0         MAKE INTO A BINARY VALUE
                   0089 *
                   0090 * GET DATA IN "A",ADDRESS IS IN "B"
                   0091 * MSB OF "A" SET FOR WRITE. MSB OF PIA IS
                   0092 * AN INPUT (PRINTER BUSY) SO IS IGNORED BY PIA
                   0093 *
7E12 8A80          0094         ORA   #$80        SET HIGH BIT FOR WRITE
7E14 C105          0095         CMPB  #5          WRITING H10?
7E16 2602          0096         BNE   CLK         NO
7E18 8A08          0097         ORA   #8          SET 24 HOURS CLOCK FLAG
7E1A 8D6D          0098 CLK     BSR   CLOCK
7E1C 6DE4          0099         TST   ,S          CHECK READ/WRITE FLAG
7E1E 2616          0100         BNE   NOTRD        NOT READING
                   0101 * see if we just read month. If it is 1 or 2
                   0102 * go to leapyear flag set routine
7E20 C109          0103         CMPB  #9          JUST READ M1?
7E22 2602          0104         BNE   NTMNTH       NOT READING MONTHS
7E24 8D3B          0105         BSR   LEAP         CHECK FOR LEAP YEAR
7E26 C105          0106 NTMNTH  CMPB  #5          READING H10?
7E28 2604          0107         BNE   NOTH10       NO
7E2A 8403          0108 BTMBIT  ANDA  #3          KEEP ONLY LOW 2 BITS
7E2C 2004          0109         BRA   SAVEIT
7E2E C108          0110 NOTH10  CMPB  #8          READING D10?
7E30 27F8          0111         BEQ   BTMBIT
7E32 8A30          0112 SAVEIT  ORA   #'0         MAKE INTO ASCII #
7E34 A780          0113         STA   ,X+         PUT READ VALUE IN ARRAY
7E36 5A            0114 NOTRD   DECB               NEXT ADDRESS
7E37 2AD1          0115         BPL   NXTVAL      DO NEXT ADDRESS
7E39 3261          0116         LEAS  1,S          RESTORE FLAG
                   0117 *
                   0118 *  SET UP CLOCK TO ENABLE INTERRUPT
7E3B C60F          0119         LDB   #$F                 A0-A3 HIGH
7E3D 8D5B          0120         BSR   WRTADD
7E3F C620          0121         LDB   #$20        READ HI,WRITE/HOLD LOW
7E41 F7FF24        0122         STB   DR
7E44 4F            0123         CLRA                    RETURN ZERO ERROR
7E45 5F            0124         CLRB
7E46 7EB4F4        0125         JMP   $B4F4       EXIT
                   0126 *****
                   0127 * THIS VERIFIES CALL FROM BASIC
                   0128 * IF IT RETURNS PASSED STRING HAS
                   0129 * AT LEAST 14 CHARACTERS.  X POINTS
                   0130 * TO FIRST CHARACTER
                   0131 *
7E49 BDB3ED        0132 TEST    JSR   $B3ED       GET VARPTR VALUE IN D
7E4C 1F01          0133         TFR   D,X         SAVE VALUE
7E4E A684          0134         LDA   ,X          GET CHARACTER COUNT
7E50 810E          0135         CMPA  #14         must be at least 14
7E52 2408          0136         BHS   OK
7E54 3262          0137         LEAS  2,S         CLEAN STACK
7E56 4F            0138         CLRA
7E57 C6FF          0139         LDB   #-1          RETURN -1 AS ERROR CODE
7E59 7EB4F4        0140         JMP   $B4F4
7E5C EC02          0141 OK      LDD   2,X         GET STRING ADDRESS
7E5E 1F01          0142         TFR   D,X         PUT IT IN X
7E60 39            0143         RTS
                   0144 *
                   0145 ***********LEAP YEAR FLAG  SET***************
                   0146 * JUST READ MONTH AND IT WAS JAN OR FEB. X IS
                   0147 * POINTING AT M1.  CHECK YEAR FOR LEAP YEAR
                   0148 * AND SET FLAG IN D10 IF SO.
                   0149 *
7E61 3406          0150 LEAP    PSHS  A,B         SAVE VALUES
7E63 E61F          0151         LDB   -1,X        SEE IF TENS ARE ZERO
7E65 C130          0152         CMPB  #'0
7E67 261E          0153         BNE   NTLEAP      NOT A ZERO
7E69 8102          0154         CMPA  #2          IS MONTH 2 OR 1?
7E6B 221A          0155         BHI   NTLEAP      AFTER FEBRUARY
7E6D A61D          0156         LDA   -3,X        GET Y10
7E6F 8030          0157         SUBA  #'0         MAKE INTO A VALUE
7E71 C60A          0158         LDB   #10
7E73 3D            0159         MUL
7E74 EB1E          0160         ADDB  -2,X        B NOW HAS YEAR VALUE
```

Software

The primary driver software is a machine code program shown in Listing 1. It is designed to be called from BASIC and will both read or set the clock, depending upon the parameters in the call. I don't propose to talk much here about the assembly code as it is fully commented.

One interesting feature is the handling of leap year. If the clock is read and the month is January or February of a leap year, the leap year flag is set in the clock. This causes February to have 29 days instead of 28. So as long as the clock is read at least once during that period, adjustment for leap year will be automatic.

Listing 2 is the complete chronograph program containing all the necessary calls to the driver routine to both read or set the clock. The driver routine from Listing 1 is contained in the data statements and is POKEd into memory each time. This is for ease of entry if you do not have an assembler. However, it's not the fastest method and you may wish to save the driver to its own binary file and have the BASIC program load it automatically, or perhaps append it

```
7E76 C030            SUBB  #'0        REMOVE ASCII PART OF Y1
7E78 C004     SUBLP  SUBB  #4         DECREASE BY 4
7E7A 2EFC            BGT   SUBLP      NOT ZERO KEEP REDUCING
7E7C 2D09            BLT   NTLEAP     WENT NEGATIVE
              *
              * IS A LEAP YEAR, READ D10 AND SET FLAG AND WRITE
7E7E C608            LDB   #$8        ADDRESS OF D10
7E80 4F              CLRA                PREPARE A FOR READ
7E81 8D06            BSR   CLOCK      READ D10
7E83 8A84            ORA   #$84       SET BIT AND WRITE FLAG
7E85 8D02            BSR   CLOCK      WRITE IT BACK
              *
7E87 3586     NTLEAP PULS  A,B,PC
              **********************************************
              *************CLOCK READ/WRITE*****************
              **********************************************
              *
              * "A" CONTAINS DATA IN LOWER 4 BITS. IF MSB=1
              * THEN WRITES DATA TO CLOCK, 0 READS FROM CLOCK
              *
              * "B" CONTAINS ADDRESS TO READ/WRITE FROM
              *
              *  ALL REGISTERS ARE RETURNED UNCHANGED EXCEPT
              * A WHEN READING.  THEN A HAS ONLY 4 LSBITS SET
              *
              ***********************************************
              *
FF24          DR     EQU   $FF24
FF25          CR     EQU   DR+1
0030          EXPDDR EQU   $30          EXPOSE DATA DIRECTION REG
0034          EXPDR  EQU   $34          EXPOSE DATA REGISTER
007F          DATOUT EQU   $7F          SET LS 4 BITS AS OUTPUTS
0070          DATIN  EQU   $70          SET LS 4 BITS AS INPUTS
003C          STROBE EQU   $3C          LET LATCH FOLLOW DATA
              *
7E89 3406     CLOCK  PSHS  A,B          PRESERVE REGISTERS
7E8B 8D0D            BSR   WRTADD     WRITE ADDRESS TO LATCH
7E8D 6DE4            TST   ,S             TEST FOR READ OR WRITE
```

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to the end of the BASIC program with one of the previously documented techniques.

If you read the comments at the beginning of Listing 1, you will see exactly how to call the driver and make it read or set the chronograph. The important points to note are that byte 14 of the passed string is either a '1' to set the clock or '0' to read it. Those are ASCII characters.

Also note that when setting the chronograph, the seconds cannot be written and are always set to zero. Therefore, enter in the time at the end of the current minute as prompted and execute the write when this exact time is reached. Seconds are returned accurately when the clock is read.

Also, the day of the week is stored in the chronograph as a number from zero to six. Listing 2 arbitrarily sets zero to equal Monday. Of course, you can set this up however you wish, just remember the relationship you used.

Finally, that wire from pin 3 to pin 40 on the new PIA provides a one second interrupt to the PIA. This interrupt is connected to the FIRQ line, but the PIA is set up to prevent the

```
7E8F 2B04      0199        BMI   DOWRT         WRITING DATA TO CLOCK
7E91 8D58      0200        BSR   READ           READ DATA FROM CLOCK
7E93 2002      0201        BRA   EXIT
7E95 8D3C      0202 DOWRT  BSR   WRITE         WRITE DATA TO CLOCK
7E97 3506      0203 EXIT   PULS  A,B            RECOVER REGISTERS
7E99 39        0204        RTS
               0205 ****************************************
               0206 ********SET UP ADDRESS IN LATCH*********
               0207 ****************************************
7E9A 8D10      0208 WRTADD BSR   OUT                    SET 4 PIA DATA LINES TO OUT
7E9C F7FF24    0209        STB   DR                      PUT ADDRESS OUT OF PIA
7E9F 863C      0210        LDA   #STROBE          LET LATCH SEE IT
7EA1 B7FF25    0211        STA   CR
7EA4 8634      0212        LDA   #EXPDR           AND THEN LOCK IT IN
7EA6 B7FF25    0213        STA   CR
               0214 *** ADDRESS DATA IS NOW LOCKED INTO THE LATCH
7EA9 8D11      0215        BSR   IN                      SET 4 BITS TO DATA IN
7EAB 39        0216        RTS
               0217 ****************************************
               0218 *   SET 4 PIA DATA LINES TO OUTPUT
7EAC 8630      0219 OUT    LDA   #EXPDDR
7EAE B7FF25    0220        STA   CR                BIT 4 LOW EXPOSES DDR
7EB1 867F      0221        LDA   #DATOUT        DATA OUTPUT
7EB3 B7FF24    0222        STA   DR
7EB6 8634      0223        LDA   #EXPDR            EXPOSE DATA REGISTER
7EB8 B7FF25    0224        STA   CR
7EBB 39        0225        RTS
               0226 ****************************************
               0227 *   SET 4 PIA DATA LINES TO INPUT
7EBC 8630      0228 IN     LDA   #EXPDDR
7EBE B7FF25    0229        STA   CR                BIT 4 LOW EXPOSES DDR
7EC1 8670      0230        LDA   #DATIN         DATA INPUT
7EC3 B7FF24    0231        STA   DR
7EC6 8634      0232        LDA   #EXPDR            EXPOSE DATA REGISTER
7EC8 B7FF25    0233        STA   CR
7ECB 39        0234        RTS
               0235 ****************************************
               0236 ** 1 CLOCK =1.117US
```

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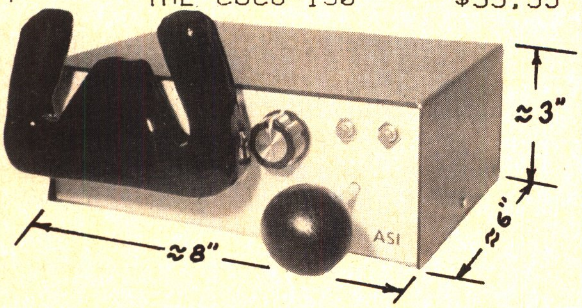

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CPU from seeing it. However, the flag bit in the PIA will indicate each time a second is counted and this can be used.

For example, the following BASIC program will cause a "beep" once a second. It will only work if you have read or set the time at least once by the program in Listing 2, as this sets up the new PIA and the chronograph for this feature.

```
10 A=PEEK(&HFF24):'TO CLEAR THE
   INTERRUPT FLAG
20 IF PEEK(&HFF25)AND &H80 THEN
   SOUND 160,1:GOTO10 ELSE 20
```

The flag which tells if there has been an interrupt from the chronograph is the most significant bit at $FF25. If this is one, then a beep is issued and the flag is reset by reading $FF24. If not, then Line 20 is re-executed until it is.

Wrapping it up

I have deliberately left some of the possible uses of the *CoCo Chronograph* to you. If you followed the "Cooking with CoCo" series, you could incorporate the clock set and read operations as BASIC commands and have the `DATE$` function automatically set on power up from a read of the clock. You could add a `TIME$` function which would return the time of day to BASIC without having to do a direct call to the driver in Listing 1.

If you didn't follow the series, there are many applications within your BASIC programs where knowing the real time, date or day of the week could be very useful. The techniques employed in Listing 2 can be used in these cases.

```
                0237 ** 30 * 5 * 1.117 = 167.55 US DELAY
7ECC C61E       0238 DELAY  LDB   #30                DELAY 150US
7ECE 12         0239 WAIT   NOP
7ECF 5A         0240        DECB                        COUNT DOWN
7ED0 26FC       0241        BNE   WAIT               7 CLOCK PULSE LOOP
7ED2 39         0242        RTS
                0243 ********************************
                0244 *****************************************
                0245 **********WRITE DATA TO CLOCK************
                0246 *****************************************
                0247 * ASSUMES ADDRESS IS SET, DATA DIRECTION IS IN,
                0248 * HOLD, READ, WRITE ALL LOW
                0249 *
7ED3 8DD7       0250 WRITE  BSR   OUT                 SET DATA TO OUT
7ED5 8640       0251        LDA   #$40               HOLD HIGH
7ED7 AA62       0252        ORA   2,S                 ADD IN DATA
7ED9 B7FF24     0253        STA   DR                   SEND IT TO PIA
7EDC 8DEE       0254        BSR   DELAY
                0255 *
                0256 * EVERYTHING NOW SET UP TO WRITE
7EDE 8A10       0257        ORA   #$10               WRITE HIGH
7EE0 B7FF24     0258        STA   DR
7EE3 840F       0259        ANDA  #$0F             WRITE LOW,HOLD LOW
7EE5 B7FF24     0260        STA   DR
7EE8 8DD2       0261        BSR   IN                   REST TO DATA IN
7EEA 39         0262        RTS
                0263 ********************************
                0264 *****************************************
                0265 **********READ DATA FROM CLOCK***********
                0266 *****************************************
                0267 * ASSUMES ADDRESS IS SET, DATA DIRECTION IS IN,
                0268 * HOLD, READ, WRITE ALL LOW
                0269 *
7EEB 8640       0270 READ   LDA   #$40               HOLD HIGH
7EED B7FF24     0271        STA   DR                   SEND IT TO PIA
7EF0 8DDA       0272        BSR   DELAY
                0273 *
                0274 * EVERYTHING NOW SET UP TO READ
7EF2 8A20       0275        ORA   #$20               READ HIGH
7EF4 B7FF24     0276        STA   DR
7EF7 F6FF24     0277        LDB   DR                   GET DATA IN B
7EFA C40F       0278        ANDB  #$0F             MASK LSB 4 BITS
7EFC E762       0279        STB   2,S                 PUT RESULT ON STACK
7EFE 7FFF24     0280        CLR   DR                   READ LOW,HOLD LOW
7F01 39         0281        RTS
                0282 ********************************
7E00            0283        END   PWRCLK
         NO ERROR(S) DETECTED
```

You will find the *CoCo Chronograph* to be very accurate and the rechargeable batteries will keep the clock running for months if you don't use your CoCo. But it's unlikely your CoCo will remain unused for that long!

Listing 2: CRNOGRPH

22	178
47	143
64	166
86	78
END	89

```
1 CLEAR 200,&H7DFF
2 DEF FNB(X)=VAL("&H"+BYTE$)
3 DIM DOW$(6),DAYS(12)
4 DATA MONDAY,TUESDAY,WEDNESDAY,
THURSDAY,FRIDAY,SATURDAY,SUNDAY
5 FOR I=0TO6:READDOW$(I):NEXT
6 DATA 31,28,31,30,31,30,31,31,3
0,31,30,31
7 FOR I=1 TO 12
8 READ DAYS(I)
9 NEXT
10 GOSUB 89 'INPUT MACHINE CODE
IF NECESSARY
11 CLS
12 IN$=STRING$(14,"0")
13 MID$(IN$,14,1)="1" 'TO SET WR
ITE FLAG
14 OUT$=STRING$(14,"0")
15 INPUT"READ OR SET TIME (R/S)"
;A$
16 IF LEFT$(A$,1)="S" THEN 24
17 GOSUB 76
18 IF RIGHT$(TIME$,2)="00" THEN
SOUND 140,1
19 PRINT@0, USING"TIME: %        %
";TIME$
20 PRINTUSING"DAY OF WEEK: %
   %";DOW$(VAL(WEEK$))
```

```
21 PRINTUSING"DATE: %      %";DT
$
22 PRINT"PRESS <BREAK> TO END"
23 GOTO 17
24 GOSUB 76
25 A$=LEFT$(TIME$,5)
26 PRINT"ENTER TIME (";A$;
27 LINEINPUT") ";K$
28 IF LEN(K$)>0 THEN A$=K$
29 IF LEN(A$)<>5 THEN 34
30 IF MID$(A$,3,1)<>":" THEN 34
31 IF VAL(LEFT$(A$,2))<0 OR VAL(
LEFT$(A$,2))>23 THEN 34
32 IF VAL(RIGHT$(A$,2))<0 OR VAL
(RIGHT$(A$,2))>59 THEN 34
33 GOTO 35
34 SOUND80,1:GOTO 24
35 B$=DOW$(VAL(WEEK$))
36 PRINT"ENTER DAY OF WEEK (";B$
;
37 LINE INPUT") ";K$
38 IF LEN(K$)>0 THEN B$=K$
39 FOR I=0 TO 6
40 IF B$=LEFT$(DOW$(I),LEN(B$))
THEN 42
41 NEXT:SOUND80,1:GOTO 35
42 DOW=I
43 'DATE LOADER
44 C$=DT$
45 PRINT"ENTER DATE (";C$;
46 LINEINPUT") ";K$
47 IF LEN(K$)>0 THEN C$=K$
48 IF LEN(C$)<>8 THEN 61
49 D=VAL(MID$(C$,4,2))
50 Y=VAL(RIGHT$(C$,2))
51 M=VAL(LEFT$(C$,2))
52 IF M<0 OR M>12 THEN 61
53 IF Y<0 THEN 61
54 IF D<1 THEN 61
55 IF M=2 THEN 58
56 IF D>DAYS(M) THEN 61 ELSE 62
57 ' DO FEBRUARY
58 IF(INT(Y/4)<>Y/4)AND(D>DAYS(M
))THEN 61
59 ' LEAP YEAR
60 IF D>29 THEN 61 ELSE 62
61 SOUND 80,1:GOTO 44
62 D$=STR$(D):IF LEN(D$)=2 THEN
MID$(D$,1,1)="0" ELSE D$=RIGHT$(
D$,2)
63 M$=STR$(M):IF LEN(M$)=2 THEN
MID$(M$,1,1)="0" ELSE M$=RIGHT$(
M$,2)
64 Y$=STR$(Y):IF LEN(Y$)=2 THEN
MID$(Y$,1,1)="0" ELSE Y$=RIGHT$(
Y$,2)
65 MID$(IN$,1,2)=Y$
66 MID$(IN$,3,2)=M$
67 MID$(IN$,5,2)=D$
68 MID$(IN$,7,1)=RIGHT$(STR$(DOW
),1)
69 MID$(IN$,8,2)=LEFT$(A$,2)
70 MID$(IN$,10,2)=MID$(A$,4,2)
71 MID$(IN$,12,2)="00"
72 INPUT"PRESS <ENTER> TO SET CL
OCK";A$
73 A=USR(VARPTR(IN$))
74 IF A<>0 THEN PRINT"ERROR":STO
P
75 CLS:GOTO 17
76 ' READ TIME ROUTINE
77 T$=MID$(OUT$,12,2)
78 A=USR(VARPTR(OUT$))
79 IF A<>0 THEN PRINT"ERROR":STO
P
80 IF MID$(OUT$,12,2)=T$ THEN 78
81 TIME$ = MID$(OUT$,8,2)+":"+MI
D$(OUT$,10,2)+":"+MID$(OUT$,12,2
)
82 WEEK$ =MID$(OUT$,7,1)
83 DT$ = MID$(OUT$,3,2)+"/"+MID$
(OUT$,5,2)+"/"+MID$(OUT$,1,2)
84 RETURN
85 DATA8D,47,C6,0C,A6,0D,80,30,3
4,02,6D,E4,27,0C,A6,80,80,30,8A,
80,C1,05,26,02,8A,08,8D,6D,6D,E4
,26,16,C1,09,26,02,8D,3B,C1,05,2
6,04,84,03,20,04,C1,08,27,F8,8A,
30,A7,80,5A,2A,D1,32,61,C6,0F,8D
,5B,C6,20,F7,FF,24,4F,5F,7E,B4,F
4,BD,B3,ED,1F,01,A6,84
86 DATA81,0E,24,08,32,62,4F,C6,F
F,7E,B4,F4,EC,02,1F,01,39,34,06,
E6,1F,C1,30,26,1E,81,02,22,1A,A6
,1D,80,30,C6,0A,3D,EB,1E,C0,30,C
0,04,2E,FC,2D,09,C6,08,4F,8D,06,
8A,84,8D,02,35,86,34,06,8D,0D,6D
,E4,2B,04,8D,58,20,02,8D,3C,35,0
6,39,8D,10,F7,FF,24,86
87 DATA3C,B7,FF,25,86,34,B7,FF,2
5,8D,11,39,86,30,B7,FF,25,86,7F,
B7,FF,24,86,34,B7,FF,25,39,86,30
,B7,FF,25,86,70,B7,FF,24,86,34,B
7,FF,25,39,C6,1E,12,5A,26,FC,39,
8D,D7,86,40,AA,62,B7,FF,24,8D,EE
,8A,10,B7,FF,24,84,0F,B7,FF,24,8
D,D2,39,86,40,B7,FF,24
88 DATA8D,DA,8A,20,B7,FF,24,F6,F
F,24,C4,0F,E7,62,7F,FF,24,39
89 'LOAD MACHINE CODE ROUTINE
90 FOR I=&H7E00 TO &H7F01:READ B
YTE$:POKEI,FNB(0):TTL=TTL+FNB(0)
:NEXT
91 IF TTL<>28319 THENPRINT"ERROR
 IN DATA STATEMENTS":STOP
92 DEF USR=&H7E00
93 RETURN
```

Your very own music teacher . . .

Learn The Ivory Keyboard With Piano Note Tutor

By Ron Mix

Usually, the first problem encountered when trying to learn how to play the piano is to learn what note on the music staff goes with what key on the piano keyboard. The *Piano Note Tutor* is designed to assist in learning the notes and the piano keyboard in a game-type format.

The tutor has been tested by the piano students who are privately taught by my wife in individual lessons, group lessons and by students alone. (Note to piano teachers: The tutor is a great game to use while one student is waiting to be picked up or while waiting for his or her lesson.)

Game Summary

The *Piano Note Tutor* gives a note on either the treble or bass staff and asks you to find the correct key on a shortened 54-note piano keyboard. The program gives you 15 seconds in which to position a pointer at the correct keyboard key using the up, down, right and left arrows. The 15 seconds are counted off in one second intervals by the program through the `SOUND` command. Of course, the faster you are, the more points you get.

The game also has three levels of play which include major notes only, sharp and flat notes only, and combined play. The more difficult the play, the higher the points for each correct answer, and in the combined play, more points are taken off for an incorrect answer.

(Ron Mix is the industrial engineering manager for Switches, Inc. He is in the process of developing educational software for his wife, Robbin, who teaches private piano lessons and religion in the public schools.)

Program Play

After loading the program into the computer, type `RUN`. A title screen will appear for a few seconds while the character generator data is read into the program. The main menu appears and a short description is given about the game, then the levels of play menu is displayed. After entering your levels of play selection, the game graphics will start to be drawn on the screen. The *Piano Note Tutor* should display a buff background, white and black piano keyboard keys with a red 'C' marking the Middle C keyboard key, and a red pointer. If these colors are not being displayed correctly, press the Reset button on your computer and retype `RUN` after the OK prompt. My computer usually starts up with the correct colors but can be finicky at times.

After the graphics are drawn, the program will give you your note to be placed using the various arrow keys. The program then waits for your move and/or answer while counting the seconds for you. To end a game or to return to the main menu, press the SHIFT and CLEAR keys at the same time. If your answer is wrong, the program

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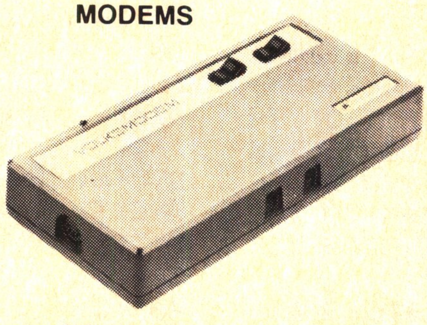

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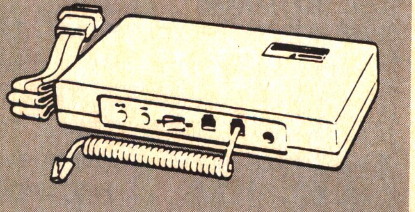

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will flash the right answer and wait for any key to be pressed while you examine the correct answer before continuing with another question.

Game Play Hints and Notes

1) The program assumes that it will take two seconds to move the pointer to the correct answer.
2) If an answer is not entered by pressing the space bar within 20 seconds, the program assumes the answer is wrong and will show you the correct answer.
3) To return at any time to the main menu, press the SHIFT and CLEAR keys together.
4) The minimum and maximum number of points given for an answer in either game is given below:

	Correct Answer		Incorrect Answer	
	Min.	Max.	Min.	Max.
Game Level 1	+1	+10	0	0
Game Level 2	+2	+20	0	0
Game Level 3	+5	+50	–5	–50

The maximum correct points will be scored if the answer is correct and entered before two seconds elapse, while the minimum correct points are scored if entered after 17 seconds elapse. Likewise, the minimum number of Level 3 incorrect points are scored after 17 seconds while the minimum number of points are scored if entered before two seconds elapse. Points between the minimum and maximum are dependent upon the time elapsed between two and 17 seconds.

System Requirements

Piano Note Tutor requires 16K Extended Color BASIC and was programmed using a silver/gray 64K Color Computer with a Color BASIC 1.1 ROM and an Extended BASIC 1.0 ROM. The tutor was tested on a 16K Color Computer 2 with a Color BASIC 1.2 ROM and an Extended BASIC 1.1 ROM with no problems. Since the seconds counter (lines 260 through 290, and 690 through 715) was based on the TIMER function instead of a FOR statement loop, the ROM compatibility can be maintained.

The high speed poke (`POKE65495,0`) is used in Line 9000 with the return to low speed poke (`POKE65494,0`) used in Line 9020. The high speed is used only to speed up the program graphics character generator. Therefore, if your Color Computer cannot handle the high speed pokes, remove these pokes from their respective lines without fear of ruining the program.

(Mr. Mix has also developed a *Staff Note Tutor* which is similar to *Piano Note Tutor*, however, it gives you a key on the piano keyboard and you must place the correct note on the grand staff. For a copy of *Staff Note Tutor*, send $5 and a blank cassette tape to 2020 Chieftain Row, Logansport, IN 46947.)

140	203
220	207
380	129
480	233
8040	155
9060	4
9220	31
END	199

The listing: NOTETUTR

```
10 DIM U(8,14),T(2),B(8,14)'PIAN
O TUTOR BY ROBBIN AND RON MIX NO
V. 1984, (C) 1985
11 DIM W(6,14)
20 R=RND(-TIMER):CLS:PRINT@200,"
PIANO NOTE TUTOR":PRINT@236,"(C)
 1985":PRINT@271,"BY":PRINT@295,
"RON AND ROBBIN MIX":GOSUB8000:F
ORX=1TO400:NEXTX
30 GOTO100
100 CLS:PRINT"FIND THE NOTE GAME
 INSTRUCTIONS ------------------
--------------  THE OBJECT OF TH
IS GAME IS TO FIND THE CORRECT K
EYBOARD NOTE  FROM A GIVEN STAFF
 NOTE. MOVE   THE POINTER TO THE
 RIGHT KEY BY USING THE RIGHT,LE
FT,UP,AND DOWN";
110 PRINT"ARROWS, THEN PRESS <SP
ACE BAR>  TO ENTER YOUR ANSWER.
IF WRONG, THE COMPUTER WILL SHOW
 THE RIGHTANSWER, THEN PRESS ANY
 KEY TO   CONTINUE. PRESS <SHIFT
> AND      <CLEAR> TOGETHER TO RE
TURN TO   MAIN PROGRAM MENU."
120 PRINT@483,"PRESS ANY KEY TO
CONTINUE";
130 I$=INKEY$:IFI$=""THEN130
135 IFI$=CHR$(92)THEN30
140 GOSUB8050:PMODE4,1:PCLS5:SCR
EEN1,1:PMODE3,1:COLOR1:KT=118:GO
SUB8030:DRAW"C3S4BM126,168":A$="
C":GOSUB9000:COLOR1:SC=0:A$="SCO
RE":DRAW"S8BM190,12":GOSUB9000:A
$=STR$(SC):DRAW"BM190,28":GOSUB9
000:A$="FIND":DRAW"BM0,12":GOSUB
9000
145 A$="THE":DRAW"BM6,28":GOSUB9
000:A$="NOTE":DRAW"BM0,44":GOSUB
9000:DRAW"S4BM128,172"+AU$:DRAW"
C1":LX=128:LY=172:GET(124,172)-(
133,187),U,G:GET(124,172)-(131,1
87),W,G:GET(110,172)-(119,187),B
,G
150 LT=0:LINE(68,40)-(68,64),PRE
SET:FORX=40TO64STEP6:LINE(68,X)-
(122,X),PRESET:NEXTX:FORX=28TO76
STEP6:LINE(122,X)-(146,X),PRESET
:NEXTX:R=RND(2):RA=RND(19):RB=RN
D(2):RC=RND(4):IF R=2 THEN DRAW"
S4BM78,68"+CT$ ELSE DRAW"S4BM78,
46"+CB$
160 DRAW"BM131,79":FORX=1TORA:DR
AW"BM-0,-3":NEXTX:IF RA<10 THEN
DRAW NU$ ELSE DRAW ND$
170 IF I=1 THEN200 ELSE IF I=3 A
ND RC>2 THEN 200
```

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Requires 64K Cass $24.95 Disk $27.95

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```
180 DRAW"BM105,80":FORX=1TORA:DR
AW"BM-0,-3":NEXTX:IF RB=1 THEN D
RAW FS$ ELSE DRAW SS$
190 IF RB=1 THEN LT=-4 ELSE LT=4
200 LT=LT+(8*RA)+(96*R)-96:FORX=
12TO236STEP56:IF LT=X THEN 250 E
LSE NEXTX
220 FORX=36TO204STEP56:IF LT=X T
HEN 250 ELSE NEXTX
240 GOTO260
250 IF RB=1 THEN LT=LT-4 ELSE LT
=LT+4
260 TA=0:SOUND90,1:TIMER=0
270 I$=INKEY$:IF I$="" THEN 280
ELSE 310
280 IF TIMER>60 THEN TA=TA+INT(T
IMER/60):SOUND90,1:TIMER=0:IF TA
>19 THEN 430 ELSE 270
290 GOTO270
310 IF I$=CHR$(92) THEN 30
320 IF I$=CHR$(32) THEN 430
330 IF I$=CHR$(8) THEN PUT(LX-4,
LY)-(LX+5,LY+15),B,PSET:LX=LX-8:
GOTO380
340 IF I$=CHR$(9) THEN PUT(LX-4,
LY)-(LX+5,LY+15),B,PSET:LX=LX+8:
GOTO380
350 IF I$=CHR$(94) AND LY=172 TH
EN PUT(LX-4,LY)-(LX+5,LY+15),B,P
SET:LY=102:LX=LX+4:GOTO380
360 IF I$=CHR$(10) AND LY=102 TH
EN PUT(LX-4,LY)-(LX+5,LY+15),B,P
SET:LY=172:LX=LX-4:GOTO380
370 GOTO270
380 IF LX<8 AND LY=172 THEN LX=8
:GOTO420
390 IF LX>248 AND LY=172 THEN LX
=248:GOTO420
400 IF LX<4 AND LY=102 THEN LX=4
:GOTO420
410 IF LX=>252 AND LY=102 THEN L
X=252:PUT(LX-4,LY)-(LX+3,LY+15),
W,PSET:GOTO270
420 PUT(LX-4,LY)-(LX+5,LY+15),U,
PSET:GOTO270
430 TA=17-TA:IF TA<0 THEN TA=0 E
LSE IF TA>15 THEN TA=15
440 IF LT=LX THEN COLOR4:LINE(19
0,16)-(255,28),PSET,BF:DRAW"C1S8
BM50,100":A$="GOOD WORK":GOSUB90
00:SC=SC+(T(I-1)/10)+INT((TA/15)
*.9*T(I-1)):DRAW"BM190,28" ELSE
450
441 IF SC>9999 THEN SC=SC-9999
445 A$=STR$(SC):GOSUB9000:FORX=1
TO600:NEXTX:COLOR4:LINE(0,84)-(2
55,100),PSET,BF:LINE(68,15)-(146
,84),PSET,BF:COLOR1:GOTO150
450 IF I=3 THEN COLOR4:LINE(190,
16)-(255,28),PSET,BF:COLOR1:SC=S
C-50+(TA*3):DRAW"S8BM190,28":IF
SC<-9999 THEN SC=SC+9999:A$=STR$
(SC):GOSUB9000 ELSE A$=STR$(SC):
GOSUB9000
460 DRAW"S8BM5,100":A$="NICE TRY
-ANSWER IS":GOSUB9000
465 IF LT=252 THEN PUT(LT-4,102)
-(LT+3,117),W,PSET:LZ=102:GOTO48
0
470 IF LT/8=INT(LT/8) THEN PUT(L
T-4,172)-(LT+5,187),U,PSET:LZ=17
2 ELSE PUT(LT-4,102)-(LT+5,117),
U,PSET:LZ=102
480 I$=INKEY$:IF I$="" THEN FORX
=1TO45:NEXTX:PUT (LT-4,LZ)-(LT+5
,LZ+15),B,PSET:FORX=1TO15:NEXTX:
GOTO465
490 IF I$=CHR$(92) THEN 30 ELSE
COLOR4:LINE(0,84)-(256,100),PSET
,BF:LINE(68,15)-(146,84),PSET,BF
:COLOR1:PUT(LT-4,LZ)-(LT+5,LZ+15
),B,PSET:GOTO150
8000 DIM L$(29),M$(29):FORX=0TO2
9:READ L$(X),M$(X):NEXTX
8010 ND$="R6DL4DR4DL4DR4DL4DR4L6
U6D18":NU$="R4DL4DR4DL4DR4DL4DR6
U18":SS$="NL4NU4NR8ND8D4R4NL8NU8
```

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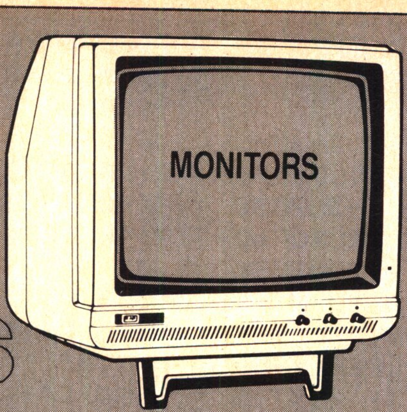

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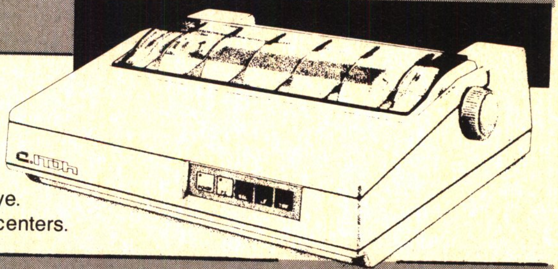

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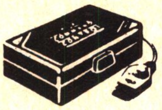

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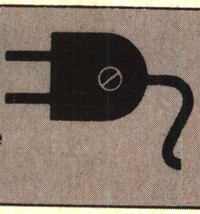

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```
NR4ND4":FS$="R4DLDLDLDLDLU12"
8011 AU$="C3NG3RNF3LDNG3RNF3LD13
NH3RNE3LUNH3RNE3"
8020 CT$="U2L2D2F3R2E3U6HU2HU2HU
2HU2HU2HU4E3F3D4LDLDLDLDLDLDLD
LDLD6LU5RD6F2R6URURURURU4H3L2G3D
3F2":CB$="U2R2D3L3ULULULURURUR6D
RDRDRD6LD2LD2LD2LD2LD2L2D2BU20BR
12R3DL3DR3BD6L3UR3UL3":RETURN
8030 LINE(0,KT)-(256,KT),PSET:LI
NE(0,KT+52)-(256,KT+52),PSET:FOR
X=4TO252STEP8:LINE(X,KT)-(X,KT+5
2),PSET:NEXTX
8040 LINE(2,KT)-(7,KT+33),PSET,B
F:FORX=18TO242STEP56:LINE(X,KT)-
(X+5,KT+33),PSET,BF:LINE(X+8,KT)
-(X+13,KT+33),PSET,BF:NEXTX:FORX
=42TO210STEP56:FORY=0TO16STEP8:L
INE(X+Y,KT)-(X+Y+5,KT+33),PSET,B
F:NEXTY:NEXTX:RETURN
8050 CLS:PRINT" LEVELS OF GAME P
LAY SELECTIONS -----------------
--------------- 1-MAJOR NOTES ON
LY  <MAX +10       POINTS IF COR
RECT AND QUICK     ENOUGH TO BEA
T THE CLOCK>    2-SHARP AND FLAT
 NOTES ONLY"
8060 PRINT"     <MAX +20 POINTS I
F CORRECT       AND QUICK TO BEAT
 THE CLOCK> 3-ALL NOTES  <MAX +5
0 POINTS        IF CORRECT AND VE
RY QUICK TO     BEAT THE CLOCK, M
AX -50 IF       WRONG AND SLOW>":
PRINT@450,"ENTER YOUR SELECTION
NUMBER"
8070 I$=INKEY$:IFI$=""THEN8070
8080 IFI$=CHR$(92)THEN30
8090 IF VAL(I$)<1 THEN8070
8100 IF VAL(I$)>3 THEN8070
8110 I=VAL(I$):T(0)=10:T(1)=20:T
(2)=50:RETURN
9000 POKE65495,0'CHR.GEN.FROMTRS
-80NEWS4/82
9010 DRAWB$:FOR X=1 TO LEN(A$):F
OR Y=0 TO 29:IF MID$(A$,X,1)=L$(
Y) THEN DRAW M$(Y)
9020 NEXTY:NEXTX:POKE65494,0:RET
URN
9030 DATA " ","BM+7,0"
9040 DATA "A","U4E2F2D2NL4D2;BM+
3,0"
9060 DATA "C","BM+1,-0;H1U4E1R2F
1;BM+0,+4;G1L2;BM+6,0"
9070 DATA "D","U6R3F1D4G1L3;BM+7
,0"
9080 DATA "E","NR4U3NR2U3R4;BM+3
,+6"
9090 DATA "F","U3NR2U3R4;BM+3,+6
"
9100 DATA "G","BM+1,-0;H1U4E1R2F
1;BM+0,+2;NL1D2G1L2;BM+6,0"
9110 DATA "H","U3NU3R4NU3D3;BM+3
,0"
9120 DATA "I","BM+1,0;R1NR1U6NL1
R1;BM+4,+6"
9140 DATA "K","U3NU3R1NE3F3;BM+3
,0"
9150 DATA "L","NU6R4U1;BM+3,+1"
9170 DATA "N","U6F1D1F2D1F1NU6;B
M+3,0"
9180 DATA "O","BM+1,0;H1U4E1R2F1
D4G1L2;BM+6,0"
9190 DATA "P","U6R3F1D1G1L3;BM+7
,3"
9210 DATA "R","U6R3F1D1G1L2NL1F3
;BM+3,0"
9220 DATA "S","BM+0,-1;F1R2E1U1H
1L2H1U1E1R2F1;BM+3,+5"
9230 DATA "T","BM+2,+0;U6NL2R2;B
M+3,+6"
9260 DATA "W","NU6E2NU1F2U6;BM+3
,6"
9280 DATA "Y","BM+0,-6;D2F2ND2E2
U2;BM+3,6"
9300 DATA "1","BM+1,0;R1NR1U6G1;
BM+6,+5"
9310 DATA "2","NR4U1E1R1E2U1H1L2
G1;BM+7,+5"
9320 DATA "3","BM+0,-1;F1R2E1H2E
2H1L3;BM+7,6"
9330 DATA "4","BM+3,0;U2NR1L3U1E
3D3;BM+4,3"
9340 DATA "5","BM+0,-1;F1R2E1U2H
1L3U2R4;BM+3,+6"
9350 DATA "6","BM+4,-5;H1L2G1D4F
1R2E1U1H1L3;BM+7,+3"
9360 DATA "7","U1E4U1L4;BM+7,+6"
9370 DATA "8","BM+1,-0;H1U1E1H1U
1E1R2F1D1G1NL2F1D1G1L2;BM+6,0"
9380 DATA "9","BM+0,-1;F1R2E1U4H
1L2G1D1F1R2;BM+4,+3"
9390 DATA "0","BM+1,0;H1U4E1R2F1
D4G1L2;BM+6,0"
9480 DATA "-","BM+0,-3;R4;BM+3,+
3"
```

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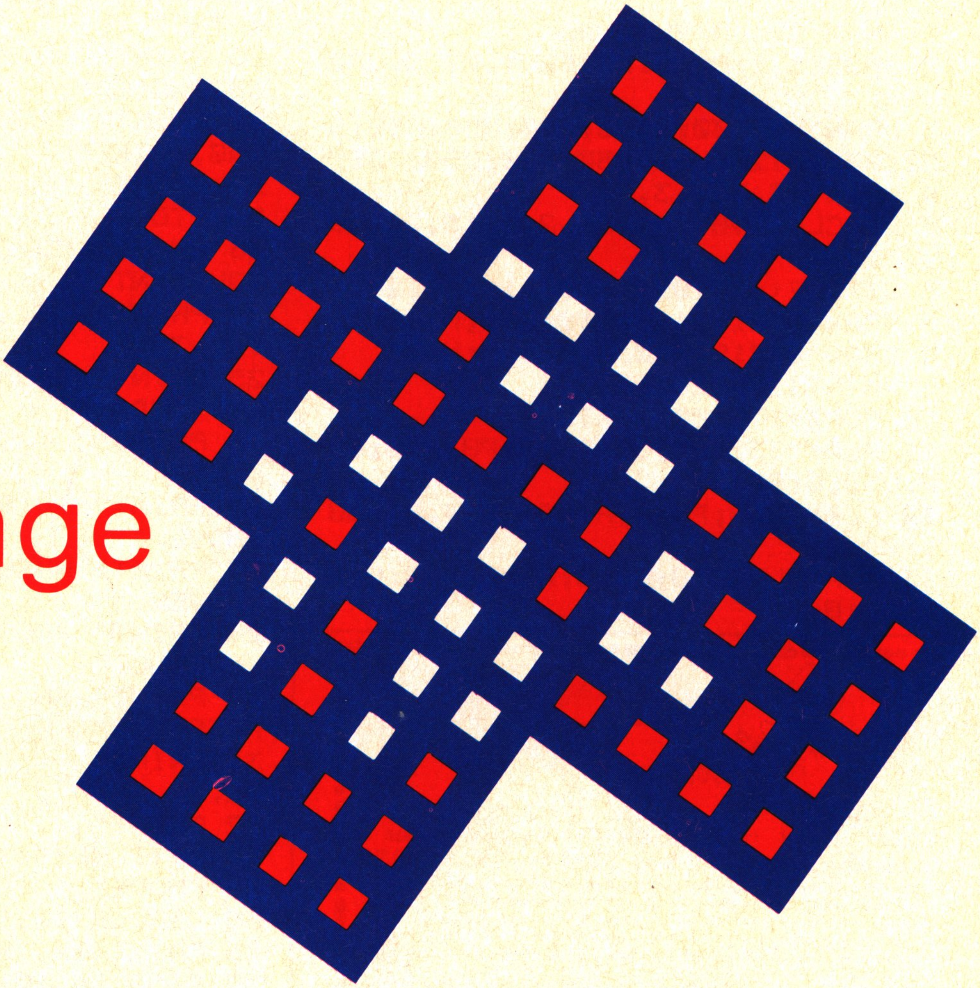
Granny's Peg-Game Challenge



By Daryl Judd

One of the memories of going to my grandmother's house is playing the puzzle-type game called *Hi-Q*. It's a small, white board with 44 red pegs that are jumped back and forth in checker-type moves. The object (which I could never seem to master) is to end up with only one peg in the middle.

I recently found out that my wife's grandmother also has the game. Is it possible this game is a requirement of some grandmothers' union? Perplexed, I pondered over this thought for several days. Then, I realized my mission: to bring the CoCo world the game of *Hi-Q* — for those whose grandmothers didn't belong to the union.

I added sight and sound and in completing my mission, I had to call on several tactics I have picked up in the past (past issues of RAINBOW, that is) such as the false colors of PMODE 3 and GET and PUT statements.

The variables are as follows:

'A' is the array used to draw the pegs
'B' is the array used to erase the pegs
Num is the number of pegs left
'M' is the x starting point of the cursor square
'L' is the y starting point of the cursor square

(Daryl Judd directs the news at KIVI TV channel six in Nampa, Idaho. He works on his computer in his spare time.)

```
20 ........69
40 .......179
73..........8
104 ......191
130 ......117
156 ......157
END ......33
```

The listing: HI-Q

```
1 'H-Q BY DARYL JUDD
2 PMODE3,1:PCLS:SCREEN1,0:COLOR2
,2
3 DRAW"BM0,30;D120;R30;U50;R50;D
50;R30;U120;L30;D50;L50;U50;L30"
4 PAINT(2,32),3,2
5 CIRCLE(190,89),56,2,1.15,.1705
,.11
6 CIRCLE(190,89),36,2,1.15,.2,.1
7 DRAW"BM217,111;H10;G15;F10"
8 DRAW"BM219,142;F10;E15;H11"
9 PAINT(190,28),3,2
10 FORX=1TO400:NEXTX
11 PLAY"T3;L8D;G;P8G;A;P8;A;B;O4
D;O3B;G;P8"
12 PLAY"D;G;P8;G;A;P8;A;L4.B;L6G
;P8"
13 PLAY"L8;D;G;P8;G;A;P8;A;B;O4D
;O3B;G;P4"
14 SCREEN1,1
15 PLAY"L8;O2E;P4;L8.;O1A;P16;L8
;O2C;L4;O1B;P8;L8G"
16 FORX=1TO700:NEXTX
17 CLS:PRINT@7,"**INSTRUCTIONS**
"
18 PRINT" THE OBJECT OF THIS GAM
E IS TO"
19 PRINT"  END UP WITH ONE PEG I
N THE"
20 PRINT"CENTER HOLE. PEGS ARE S
UBTRACTED";
21 PRINT" FROM THE BOARD BY JUMP
ING, LIKE";
22 PRINT"  IN THE GAME OF CHECKE
RS. TO"
23 PRINT" MOVE THE SQUARE WHERE
YOU WANT"
24 PRINT" IT, PRESS THE ARROW KE
YS. TO"
25 PRINT"  JUMP, PRESS THE 'J' K
EY. AND"
26 PRINT"  THEN THE ARROW KEY IN
 THE"
27 PRINT"  DIRECTION YOU WANT TO
 MOVE."
28 PRINT" WHEN THERE ARE NO MORE
 MOVES,"
29 PRINT" PRESS THE 'N' FOR YOUR
 RATING."
30 PRINT" AND IF WANT TO QUIT, P
RESS THE"
31 PRINT"       'Q' KEY AND YOU WI
LL."
32 PRINT"          **ANY KEY**";
33 I$=INKEY$:IFI$=""THEN33
34 PMODE3,1:PCLS0
35 CIRCLE(10,10),7,3,.9
36 PAINT(10,10),3,3
37 DIMA(14,10),B(14,10)
38 GET(3,5)-(17,15),A,G
39 GET(33,5)-(47,15),B,G
40 CLS3:PMODE4,1:PCLS:SCREEN1,1:
PMODE3
41 PCLS0:NUM=44
42 COLOR1,1
43 LINE(10,0)-(246,185),PSET,B
44 LINE(10,0)-(88,62),PSET,BF
45 LINE(166,0)-(244,62),PSET,BF
46 LINE(10,123)-(88,185),PSET,BF
47 LINE(166,123)-(246,185),PSET,
BF
48 FORX=96TO146STEP25
49 FORY=8TO48STEP20
50 PUT(X,Y)-(X+14,Y+10),A,PSET
51 NEXTY:NEXTX
52 FORX=21TO221STEP25
53 FORY=68TO108STEP20
54 IFX=121ANDY=88THEN56
```

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Rainbow Review 3/85

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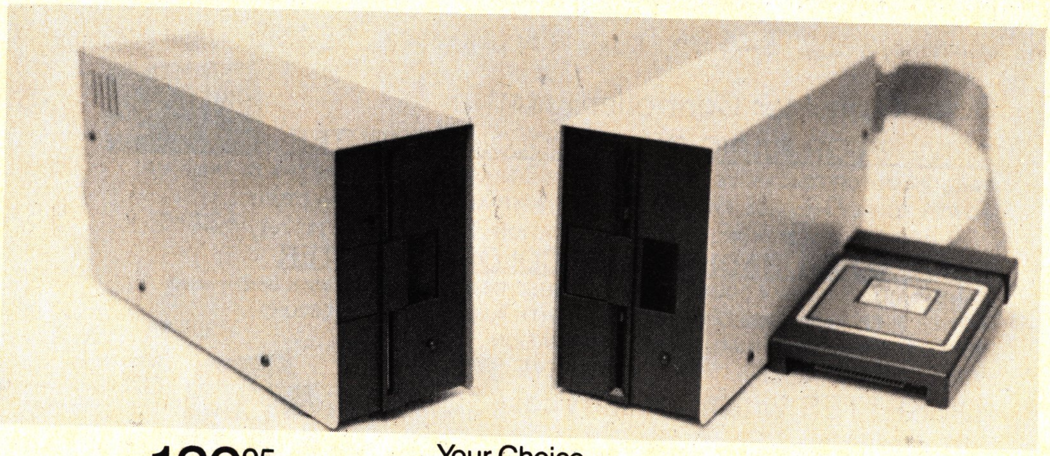
```
55 PUT(X,Y)-(X+14,Y+10),A,PSET
56 NEXTY:NEXTX
57 FORX=96TO146STEP25
58 FORY=128TO168STEP20
59 PUT(X,Y)-(X+14,Y+10),A,PSET
60 NEXTY:NEXTX
61 COLOR1,1
62 M=119:L=86
63 GOSUB106
64 'WAIT FOR COMMAND
65 I$=INKEY$:IFI$=""THEN65
66 IFI$=CHR$(94)THEN74
67 IFI$=CHR$(10)THEN82
68 IFI$=CHR$(8)THEN90
69 IFI$=CHR$(9)THEN98
70 IFI$="J"THEN108
71 IFI$="N"THEN163
72 IFI$="Q"THEN175
73 GOTO64
74 'MOVE UP
75 IFL=66ANDM<94THEN78
76 IFL=66ANDM>144THEN78
77 IFL>6THEN79
78 SOUND10,2:GOTO64
79 COLOR4,4:GOSUB106
80 COLOR1,1:L=L-20:GOSUB106
81 GOTO64
82 'MOVE DOWN
83 IFL=106ANDM<94THEN86
84 IFL=106ANDM>144THEN86
85 IFL<166THEN87
86 SOUND10,2:GOTO64
87 COLOR4,4:GOSUB106
88 COLOR1,1:L=L+20:GOSUB106
89 GOTO64
90 'MOVE LEFT
91 IFM=94ANDL<66THEN94
92 IFM=94ANDL>106THEN94
93 IFM>19THEN95
94 SOUND10,2:GOTO64
95 COLOR4,4:GOSUB106
96 COLOR1,1:M=M-25:GOSUB106
97 GOTO64
98 'MOVE RIGHT
99 IFM=144ANDL<66THEN102
100 IFM=144ANDL>106THEN102
101 IFM<219THEN103
102 SOUND10,2:GOTO64
103 COLOR4,4:GOSUB106
104 COLOR1,1:M=M+25:GOSUB106
105 GOTO64
106 LINE(M,L)-(M+18,L+14),PSET,B
107 RETURN
108 'JUMP
109 IFPPOINT(M+9,L+7)<>7THEN64
110 I$=INKEY$:IFI$=""THEN110
```



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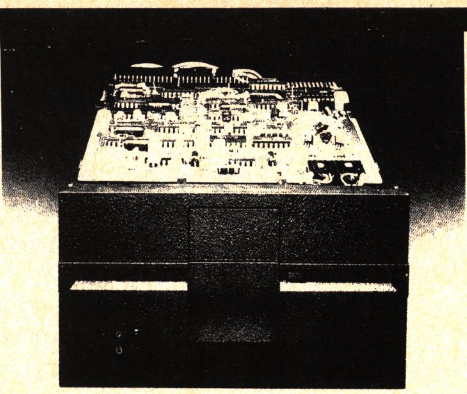

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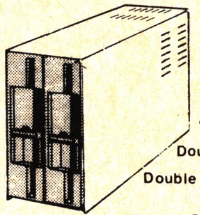

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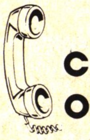

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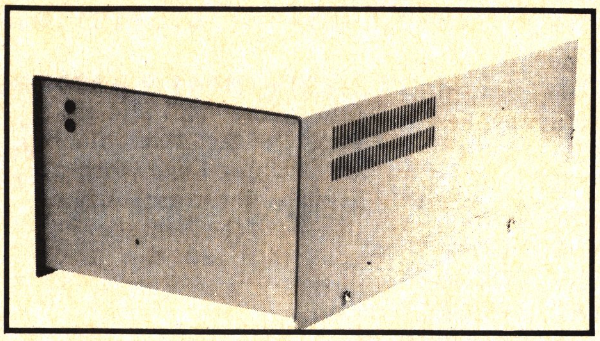

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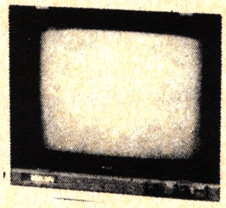

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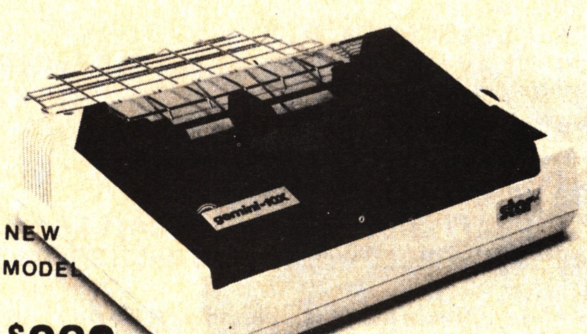

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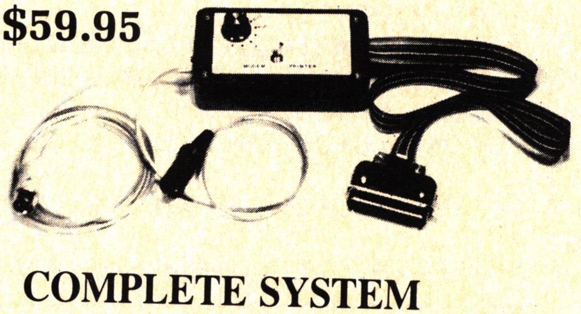

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```
111 IFI$=CHR$(94)THEN116
112 IFI$=CHR$(10)THEN127
113 IFI$=CHR$(8)THEN138
114 IFI$=CHR$(9)THEN149
115 SOUND10,2:GOTO110
116 'JUMP UP
117 IFL<46THEN160
118 IFPPOINT(M+12,L-13)<>7THEN16
0
119 IFPPOINT(M+12,L-33)<>8THEN16
0
120 COLOR4,4:GOSUB106
121 PUT(M+2,L+2)-(M+16,L+12),B,P
SET
122 PUT(M+2,L-18)-(M+16,L-8),B,P
SET
123 PUT(M+2,L-38)-(M+16,L-28),A,
PSET
124 COLOR1,1:L=L-40:GOSUB106
125 NUM=NUM-1
126 GOTO64
127 'JUMP DOWN
128 IFL>130THEN160
129 IFPPOINT(M+12,L+27)<>7THEN16
0
130 IFPPOINT(M+12,L+47)<>8THEN16
0
131 COLOR4,4:GOSUB106
132 PUT(M+2,L+2)-(M+16,L+12),B,P
SET
133 PUT(M+2,L+22)-(M+16,L+32),B,
PSET
134 PUT(M+2,L+42)-(M+16,L+52),A,
PSET
135 COLOR1,1:L=L+40:GOSUB106
136 NUM=NUM-1
137 GOTO64
138 'JUMP LEFT
139 IFM<69THEN160
140 IFPPOINT(M-14,L+7)<>7THEN160
141 IFPPOINT(M-39,L+7)<>8THEN160
142 COLOR4,4:GOSUB106
143 PUT(M+2,L+2)-(M+16,L+12),B,P
SET
144 PUT(M-23,L+2)-(M-9,L+12),B,P
SET
145 PUT(M-48,L+2)-(M-34,L+12),A,
PSET
146 COLOR1,1:M=M-50:GOSUB106
147 NUM=NUM-1
148 GOTO64
149 'JUMP RIGHT
150 IFM>169THEN160
151 IFPPOINT(M+35,L+7)<>7THEN160
152 IFPPOINT(M+60,L+7)<>8THEN160
153 COLOR4,4:GOSUB106
154 PUT(M+2,L+2)-(M+16,L+12),B,P
SET
155 PUT(M+27,L+2)-(M+41,L+12),B,
PSET
156 PUT(M+52,L+2)-(M+66,L+12),A,
PSET
157 COLOR1,1:M=M+50:GOSUB106
158 NUM=NUM-1
159 GOTO64
160 'REJECT MOVE
161 SOUND10,2
162 GOTO64
163 'NO MORE MOVES
164 CLS:PRINT@36,"YOU FINISHED W
ITH";NUM"PEGS"
165 IFNUM>7THENR$="IT'S ONLY A G
AME"
166 IFNUM<8ANDNUM>5THENR$="KEEP
TRYING"
167 IFNUM<6ANDNUM>3THENR$="GOOD
SCORE!"
168 IFNUM<4ANDNUM>1THENR$="VERY
GOOD!"
169 IFNUM=1THENR$="OLYMPIC HOPEF
UL"
170 IFNUM=1ANDPPOINT(128,93)=7TH
ENR$="YOUR PERFECT!"
171 PRINT@105,R$
172 PRINT@294,"ANOTHER ROUND (Y/
N)"
173 I$=INKEY$:IFI$=""THEN173
174 IFI$="Y"THEN40
175 'QUIT
176 CLS:SCREEN 0,1
177 PLAY"T4;O3;L4E-;L3E;G;O4;C;P
4"
178 CLS(4)
179 PLAY"O3;L4E;L3D;G;B;P4"
180 CLS(2)
181 PLAY"L5G;L2G-;L5G;L3A;L8A-;L
5A;O4;C;O3;L2B;L8B-;A;A-;L2G;P4"
182 CLS(3)
183 PLAY"L4E-;L3E;G;O4;C;P4"
184 CLS(5)
185 PLAY"O3;L4E;L3D;G;B;P4"
186 CLS(8)
187 PLAY"L5G;L2G-;L5G;B;L3A;L4G-
;L2.G;O4;L8;T12;D;E;G-;L2G"
188 CLS(1)
```

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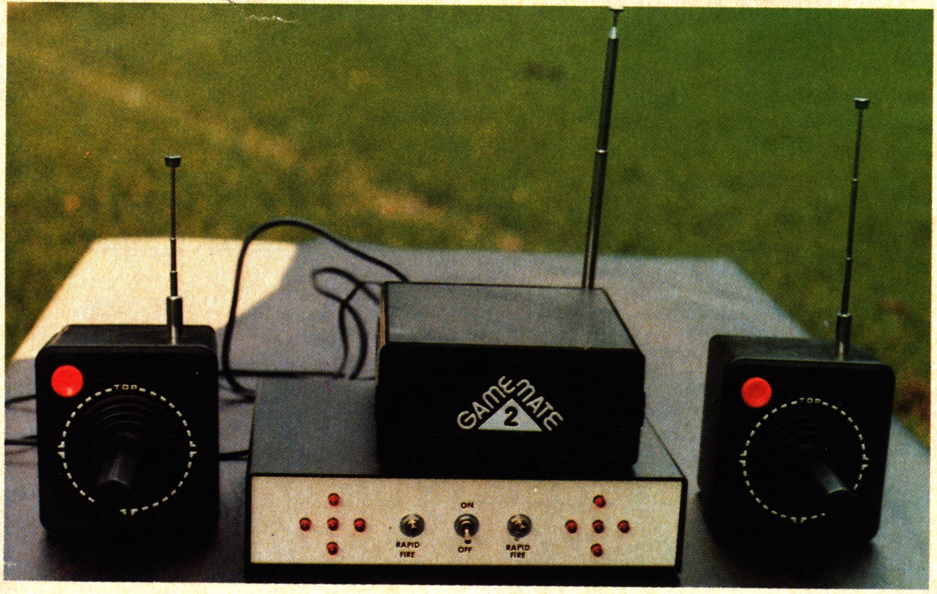
By J.O. Shaver



ON
OFF
RAPID FIRE
RAPID FIRE

For some time I had noticed that wireless joysticks were available for the Atari and Commodore computers, but, as usual, nothing for CoCo. It seemed it would be nice to have joysticks without wires so I could move back from the CoCo and TV to play a game and not have to sit shoulder to shoulder with the person I might be playing the game with.

Since I had an Atari-to-CoCo joystick adapter, I thought just maybe the wireless receiver could be plugged into this adapter and I would have it made. Finally, the urge overtook me and I purchased the wireless joysticks.

I rushed home and quickly set up the wireless joysticks, plugged them into the Atari adapter and the adapter into my CoCo. Turning the CoCo on, nothing happened. What a disappointment! I couldn't even get the keyboard to respond. At first, I thought I had even damaged my CoCo.

Being an electronic hobbyist and experimenter, and a hardware-type person for the last 30 years, this presented me with a real challenge. I decided to design and make an interface for the wireless joysticks for the CoCo.

To start, I needed to know what the output section of the wireless receiver looked like and how it worked. By

---

(Jim Shaver is an electrical engineer and works in field service for Westinghouse Electric Corp. His favorite hobby is experimenting with hardware projects for the CoCo.)

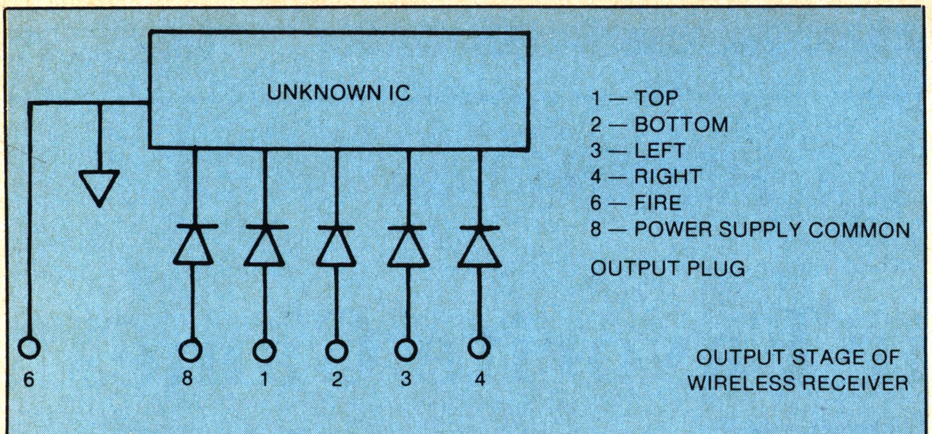


Figure 1

opening up the unit and following out the circuit, I found the circuit as shown in Figure 1.

By using an ohmmeter, I found a high resistance between pins with a diode and common. This value dropped to approximately 900 ohms when the joystick was operated for that particular direction. By seeing that change, I was also able to find which pin went with which direction. It came out as shown in Figure 1.

With this information, I proceeded with the interface.

About the Circuit

Refer to figures 2a and 2b. I will describe the left joystick side only since both left and right are identical, except for IC pin numbers in some cases.

IC1 is an Octal Inverting Buffer with control gates for each of two groups of four buffers. See Figure 3 for its internal diagram. Resistors R1-R5 are pull-up resistors for the inputs.

With the wireless joystick in the center position, the wireless receiver has a high resistance between its pins 1, 2, 3, 4, 6 and ground pin 8. This allows a +5 volt (a logical one) on the inputs of IC1 which gives a zero on the output, provided the control gates are enabled (more on this later).

If the joystick is moved to the top position, pins 1 to 8 drop to approximately 900 ohms. This causes a voltage drop across resistor R5, which produces a logical zero on pin 2 of IC1 which, in turn, produces a logical one on pin 18. In the same manner, other positions of the joystick will do the same.

While experimenting with the wireless joystick, I found some conditions would cause random outputs of the wireless receiver. Left and right, top and bottom, or any combination could occur. This usually happened when the receiver was on without the joysticks being turned on, or when the joysticks were turned off without turning off the receiver.

Since the CoCo cannot tolerate this condition, I added IC2 and used IC1's control gate. IC2 is a quad 2 input NOR gate. Each section looks at opposites (top-bottom or left-right) and if opposites try to occur, it disables IC1's control gate which results in a zero output from IC1.

If, for example, wireless receiver pins 1 and 2 both go low (top and bottom

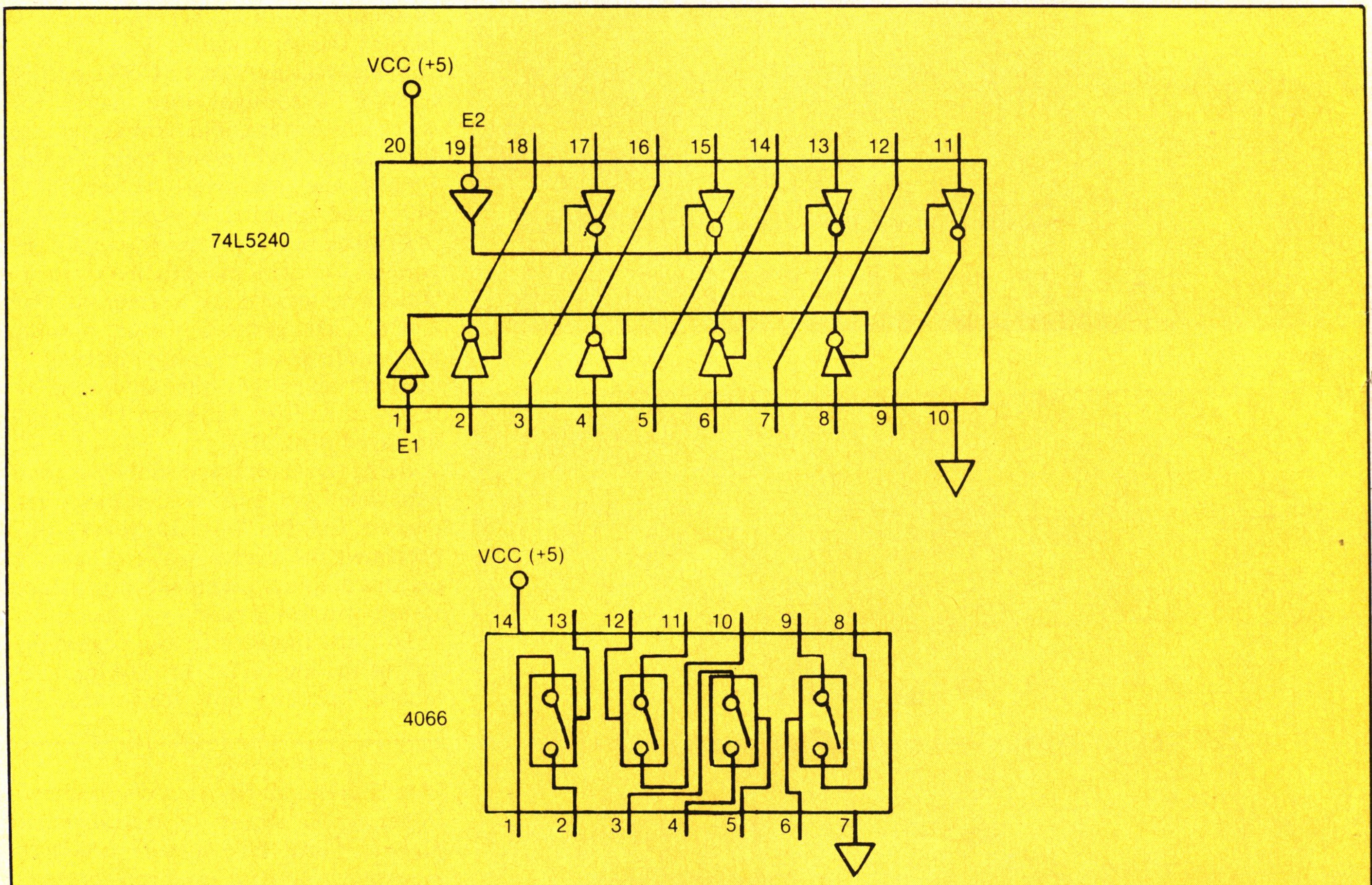
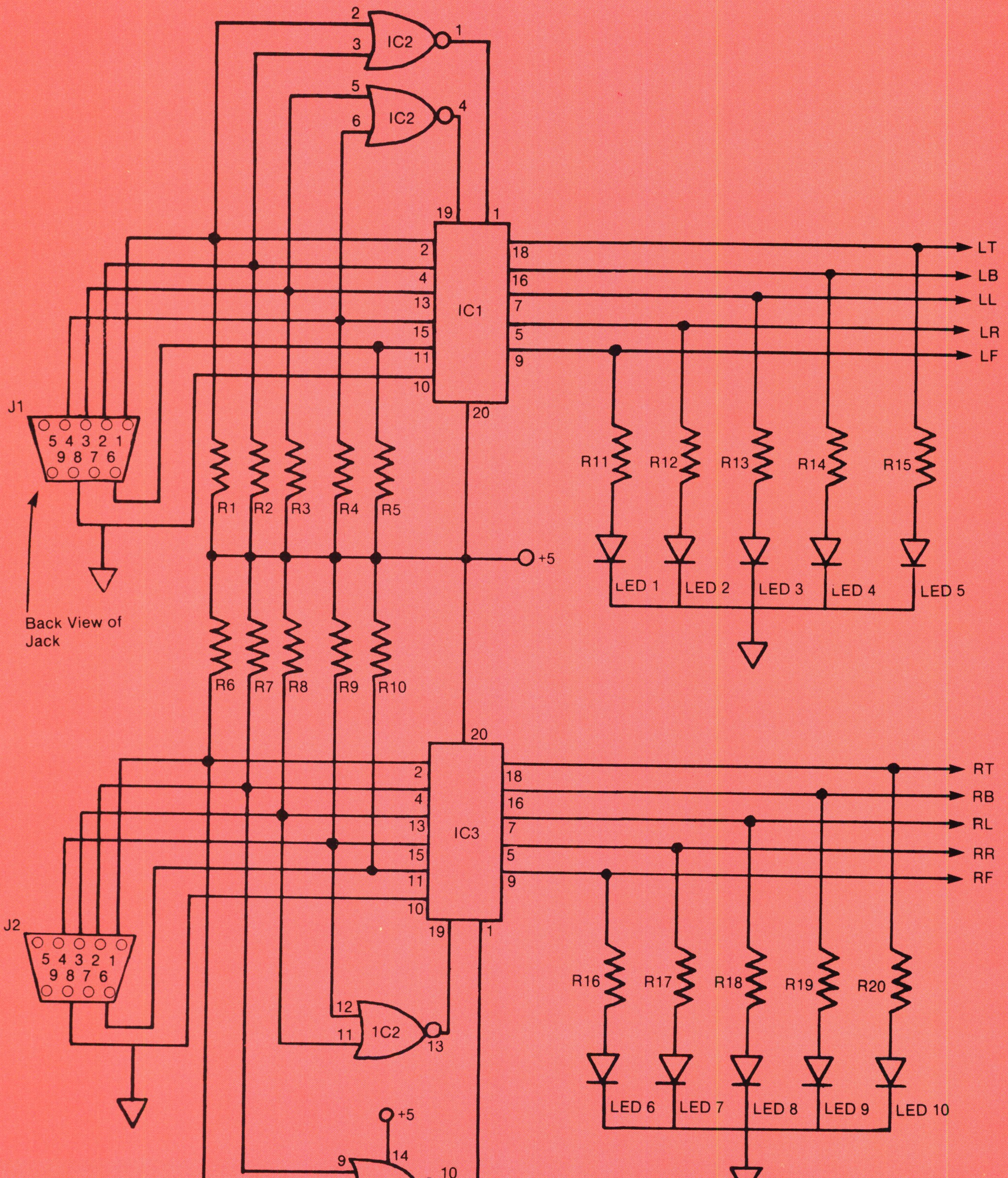


Figure 3



IC1
IC2
IC3
J1
J2
5 4 3 2 1
9 8 7 6
Back View of Jack
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
LED 1
LED 2
LED 3
LED 4
LED 5
LED 6
LED 7
LED 8
LED 9
LED 10
+5
LT
LB
LL
LR
LF
RT
RB
RL
RR
RF

Figure 2a

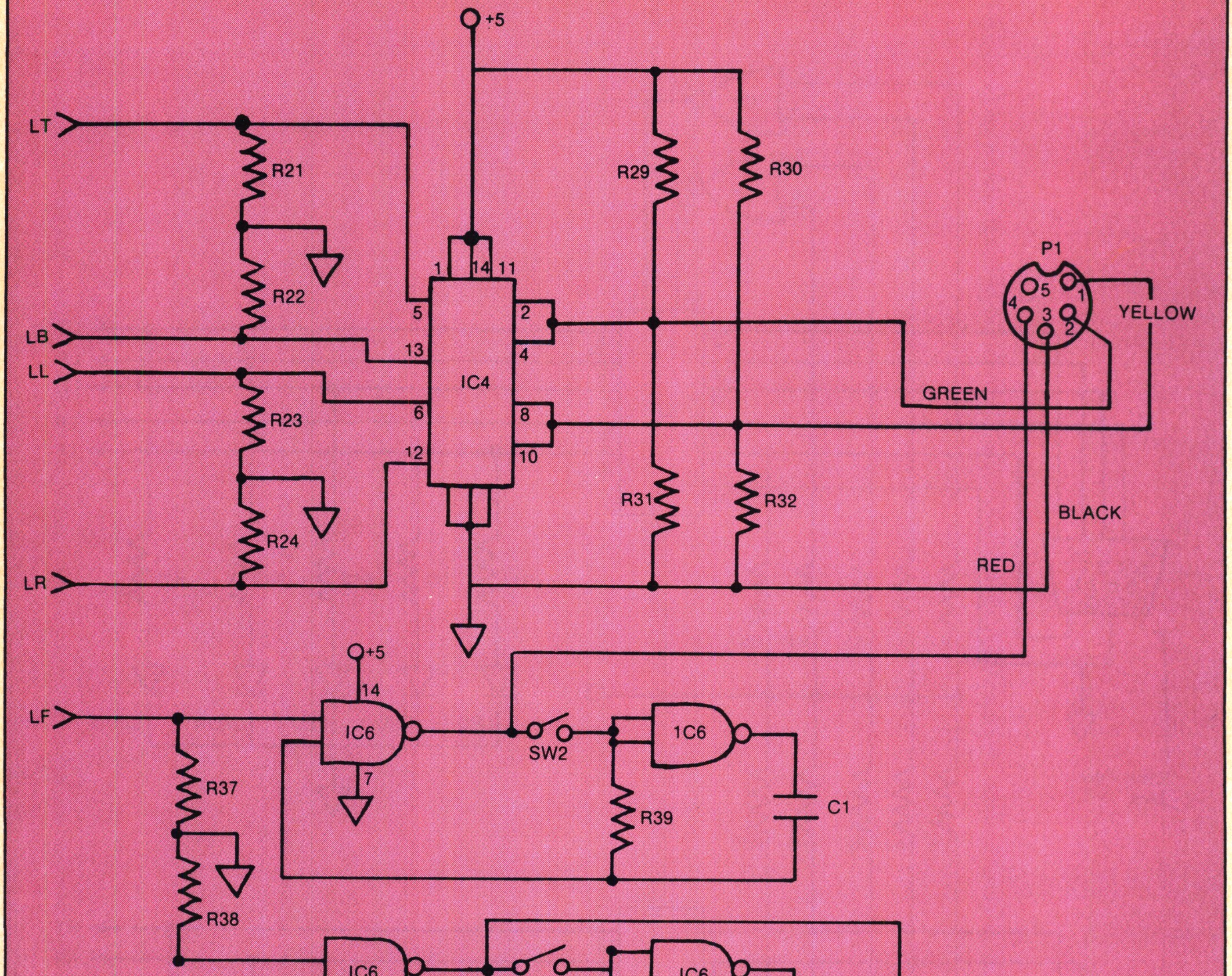

+5
LT
LB
LL
LR
R21
R22
R23
R24
R29
R30
R31
R32
IC4
1
14
11
5
2
13
4
6
8
12
10
P1
5
1
4
3
2
YELLOW
GREEN
BLACK
RED
+5
14
LF
IC6
7
SW2
1C6
R37
R38
R39
C1
IC6
SW3
IC6
C2
R40
RF
RT
RB
RL
RR
R25
R26
R27
R28
R33
R34
R35
R36
P2
RED
YELLOW
GREEN
BLACK
1
14
11
5
2
13
4
8
6
10
12
9
3
7

Figure 2b

at the same time), pin 1 of IC2 goes high (logical one) putting a one on pin 1 on IC1, which disables IC1's gate for these inputs. The left and right inputs are handled in the same manner.

As an added frill, I put LEDs on the output of IC1 and arranged them physically to represent the positions of the joystick with "fire" in the center. (These LEDs are really not necessary, but I like a lot of lights.)

The position outputs of IC1 feed into IC4 which is a Quad Bilateral switch. This is where the logical ones and zeros will be converted to the analog voltages the CoCo needs. Refer to Figure 4.

With zero inputs on IC4, both electronic switches are open; therefore, since R29 = R31, they equally divide the +5 volts and this results in 2.5 volts to the CoCo joystick input. This is the center position.

When S1 receives a logical one, it closes, shorting out R29 which sends the +5 volts to the CoCo. This is the bottom or right position on the screen.

When S2 receives a logical one, it closes, shorting out R31, resulting in zero volts to the CoCo. This is the top or left position on the screen.

IC2 prevents a logical one from reaching both S1 and S2 at the same time. As you can see, this would result in a short between the +5 and ground. Resistors R21-R28 are there as pull-down resistors to hold IC4's gate at zero with no input. Since R29-R39 form voltage dividers, they should be matched as closely as possible or your center position may be off a little.

For those of you who want centering, you could use a 100K "pot" with its wiper tied to pins 2 and 4, and its ends tied to +5 and ground, respectively, in place of R29 and R31, and the other voltage divider resistors in the circuit.

For the "fire" function, the CoCo wants a zero for a "fire" command and +5 volts for "no fire." Since I had to use another IC to invert the fire signal anyway, I thought that I would just as soon use the other two sections of the IC and add an "auto-fire" circuit.

IC6 is a quad 2 input NAND. Each half is used as a gated oscillator. Logical signal LF coming from IC1 is a logical one when you press the firebutton on the joystick. If SW2 is open, then this signal is inverted and sent to the CoCo. If SW2 is closed, the circuit oscillates and sends pulses to the CoCo, simulating pressing the firebutton rapidly.

Power from the CoCo is not used in this interface. The wireless joysticks you buy assume you already have an Atari CX2600 game computer. The wall mounted transformer/power supply plugs into the wireless receiver and the wireless receiver has a plug made to plug into the CX2600. This is a nine-volt power supply (center positive). I took the nine-volt DC out of the wireless receiver, brought it into the interface and regulated it down to +5 volts with a 7805 voltage regulator. Refer to Figure 5.

Construction

Layout and wiring are not critical. Wire wrapping or point-to-point wiring and soldering is OK. I mounted the IC sockets on a perf board with solder pads and used point-to-point wiring. The circuit board was mounted in a small cabinet purchased at Radio Shack and the LEDs were mounted on the left and right sides and arranged to represent the positions of the joystick.

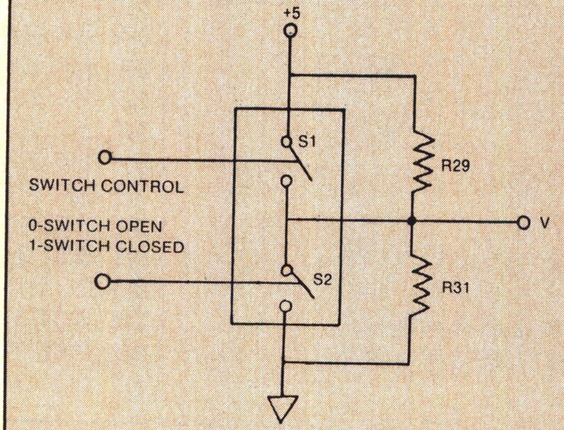
SW1, the power switch, was placed on the front center and the left and right auto-fire switches, SW2 and SW3 on each side of the power switch. Input jacks to accept the wireless receiver output plugs were placed on the back of the cabinet.

The part number specified for the Radio Shack joystick plugs includes a three-foot cable attached to the plug. The cable end was brought in through grommets in the rear panel. The power supply input jack was located in the rear.

Testing and Checkout

Before installing any of the ICs, double-check your wiring against the schematic. Make sure you brought the +5 and common to all the required points. Install IC1, IC2 and IC3 only at this time.

Get out your wireless joystick and receiver and plug the output of the receiver into the interface. Plug the



S1	S2	V
OPEN	OPEN	2.5V
CLOSED	OPEN	5.0V
OPEN	CLOSED	0.0V
CLOSED	CLOSED NOT ALLOWED	

Figure 4

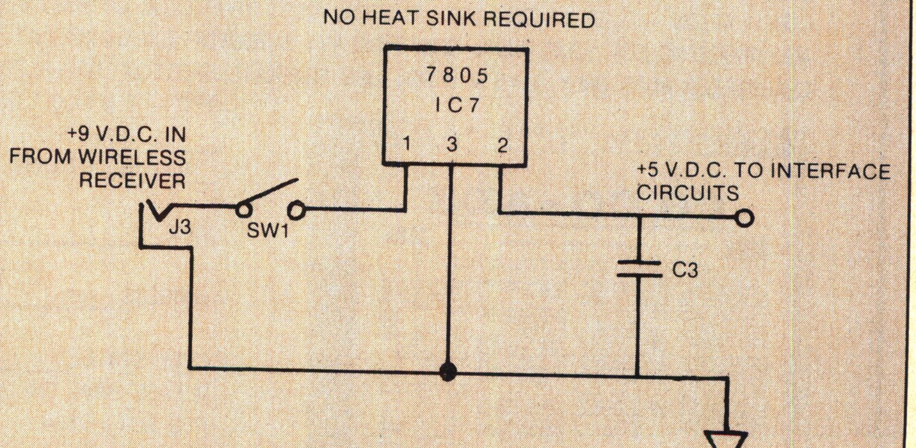


Figure 5

Atari CX2600 power supply into the receiver and the power plug coming out of the receiver into the interface. Do not plug the interface output plug into the CoCo at this time. Turn on the joysticks and plug in the CX2600 power supply.

Now operate the joysticks and the LEDs that correspond to the joystick position should light up. Opposing LEDs (top-bottom or left-right) should not light up at the same time. Turning off either or both joysticks may cause random LED indication, but opposing lights should never come on.

Now turn off the interface and install IC4, 5 and 6. Care should be taken when handling these integrated circuits since they are of the CMOS type. Plug the output plugs from the interface into the CoCo. Turn on the CoCo and type in the program listing in Figure 6.

Now turn on the interface and run the program. When you operate the left and right joysticks, you should get the numbers for the various positions of the joystick as shown in the table in Figure 6. Pushing the left or right firebutton will give an indication of "fire right" or "fire left."

RIGHT JOYSTICK	LEFT	CENTER	RIGHT
X RIGHT=	0	31	63
RIGHT JOYSTICK	TOP	CENTER	BOTTOM
Y RIGHT=	0	31	63

LEFT JOYSTICK	LEFT	CENTER	RIGHT
X LEFT=	0	31	63
LEFT JOYSTICK	TOP	CENTER	BOTTOM
Y LEFT=	0	31	63

Figure 6

This completes the checkout of the interface. If everything went as outlined above, you are ready to load one of your favorite games and start playing.

There are at least two wireless joysticks for the Atari and Commodore available. One is the RGA Model No. RGA-118, which sells for $34.95. There is also another type made by Cynex Manufacturing Corporation which is called the Game Mate 2. I have the Game Mate 2 and it has a range of approximately 40 feet with reliable operation. Most of the popular games will work with these joysticks; however, some games that require a continuously variable analog input will not function properly.

The listing: JSTKTEST

```
2 REM JOYSTK TEST
5 CLS(1)
10 XR=JOYSTK(0)
20 YR=JOYSTK(1)
30 XL=JOYSTK(2)
40 YL=JOYSTK(3)
50 PRINT @ 256,"X RIGHT=";XR
60 PRINT @ 320,"Y RIGHT=";YR
70 PRINT @ 384,"X LEFT=";XL
80 PRINT @ 448,"Y LEFT=";YL
90 F=PEEK(65280)
100 IF F=126 THEN GOTO 140
110 IF F=254 THEN GOTO 140
120 IF F=125 THEN GOTO 160
130 IF F=253 THEN GOTO 160
131 IF F=127 THEN GOTO 134
132 IF F=255 THEN GOTO 134
134 PRINT @ 192,"PUSH TO FIRE"
135 GOTO 10
140 PRINT @ 192,"FIRE RIGHT"
150 GOTO 10
160 PRINT @ 192,"FIRE LEFT"
170 GOTO 10
```

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Rommaster is a circuit board with a rotary switch and sockets for three EPROM's (24 or 28 pin) that can be individually selected. You can now have up to three versions of Basic and three versions of Extended Basic in your Coco at the same time.

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DISK UTILITY

64K Disk

Super-Disk Charger Puts The 'Turbo' In Your Drives

By Dennis Bironas

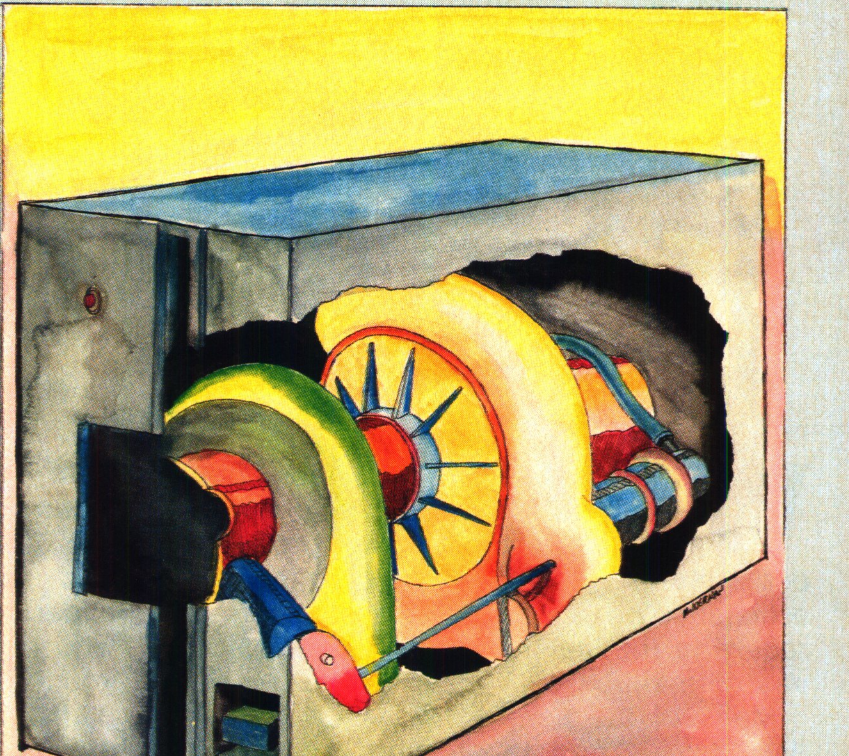
Two years ago disk drives were outrageously expensive. Consequently, most CoCo owners were using cassette recorders. I, too, wasn't in a position to shell out the more than $600 for two single-sided drives and an interface. Radio Shack's drives couldn't even get past track 35.

The story is different today. I have seen new double-sided, double-density 40-track disk drives for under $100, less the controller which is around $80, from the Radio Shack warehouse as a replacement part. There are at least other interfaces from other companies available.

Hence the problem: Only a single side will be accessed if double-sided drives are used. Also, track-to-track access time, with the Disk BASIC, will be an incredibly slow 30 milliseconds.

Here is a solution to the problem! This program will allow you to buy any type of plug compatible 40-track disk drive and tailor the Disk BASIC to your needs. All that is required is for your computer to have 64K of RAM, or for you to burn your own EPROM and use it in the disk controller.

(Dennis Bironas holds a bachelor's degree in electrical engineering technology and has taught in the E.E.T. Department at Indiana University at Kokomo. He works for Delco Electronics in advanced development as a project engineer. Dennis and his wife own Micro-Connection and sell peripherals for the CoCo.)



The modification requires you to run the BASIC program called *CHARGER*. You will then be prompted for answers. You will be able to change the Baud rate and to use either single- or double-sided disk drives at a six or 12 millisecond step rate.

Not included in the options of my

RAINBOWfest℠

Oct. 18-20

New Brunswick

Where but at **RAINBOWfest** could you meet so many CoCo enthusiasts, see so many new products, and attend seminars that are of immediate assistance? It's the next best thing to receiving the latest issue of THE RAINBOW in your mailbox.

Many of the people who write for THE RAINBOW — and those who are written about — are there to meet you and answer your questions, technical and otherwise. **RAINBOWfest** is CoCo's very own show, and it's a people-to-people event as well as a valuable learning experience.

To make it easier for you to attend, we schedule **RAINBOWfest** in three parts of the country. If you missed the fun in Irvine, Calif., and Chicago, why don't you make plans now to be with us in New Brunswick, N.J.? Each show is unique, offering fun, new acquaintances, and great sharing experiences. For members of the family who don't share your affinity for CoCo, you'll be comfortable knowing that each **RAINBOWfest** is located in an area that will provide fun and enjoyment for all.

The Hyatt Regency offers special rates ($62, single or double room) for **RAINBOWfest**. The show opens Friday evening with a 7 p.m. to 10 p.m. session. It's a daytime-only show Saturday — the CoCo Community Breakfast is at 8 a.m., then the exhibit hall opens promptly at 10 a.m. and runs continuously until 6 p.m. There will be no exhibition hours or seminars Saturday evening. On Sunday, the exhibit hall opens at 11 a.m. and closes at 4 p.m.

A well-known speaker will again keynote the highly popular CoCo Community Breakfast. And you can set your own pace in the exhibit hall intersperced with a number of seminar sessions on all aspects of CoCo — from improving your BASIC skills to working with the OS-9 system.

But most of all, there will be exhibitors. Lots of them. All ready to demonstrate products of every kind. It's a time for unveiling brand new products. Many have special buys for **RAINBOWfest**. If you've been eyeing something in THE RAINBOW, you can try it out and take it home that very day.

Tickets may be obtained directly from THE RAINBOW. We'll also send you a special reservation form so you can get your special room rate.

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program is the ability to use Disk BASIC for 40 tracks. If you want 40 tracks instead of 35, add these lines:

```
POKE&HD1B0,40:POKE&HD572,40:POKE&HD595,40
POKE&HD35F,78:POKEC708,78:POKE&HC78B,78
POKE&HC7A0,78:POKE&HC7BF,78:POKE&HCC4C,78
POKE&HCDD9,78:POKE&HD446,39:POKE&HC72A,1
```

The listings are included so you may type them in and add, delete, and generally modify them to suit your needs. You will have to input the machine language programs either with pokes or by assembling them and saving them on disk as follows:

Program Name	Used As
BOOT6	DS 6 ms
BOOT	DS 12 ms
SSDC6	SS 6 ms
SSDC	SS 12 ms

The data starting at locations E3A and E50 should be changed to $0115 if a 12 ms step is required.

The data staring at locations E42 and E59 should be changed to $121212 if single-sided drives are used.

This program at least allows you to buy the kind of disk drive you want, or as your economics dictate. Today you can buy a double-sided drive as inexpensively as you can a single-sided. I am sure you will learn that with the CoCo, you are not bound to Tandy's disk drives. CoCo users are indeed a fortunate breed!

Super-Disk Charger automatically checks to see which version of DOS you have. This means new users and old-timers alike will be able to use the *CHARGER* with *no* modifications to your machines. (I understand that Version 1.2 DOS will be available soon.)

Type in (with the *CHARGER* in Drive0) `RUN "CHARGER"`. The program is menu driven. You may select your Baud rate and disk step rate from the menu. DS means double-sided; SS means single-sided. Therefore, you may select double-sided or single-sided disk drives for a six or 12 ms step rate. Normal power-up step rate is 30 ms. Wow! That's an increase of 2.5 to 6 times faster.

In a bad case calculation with the head resting on Track 35, the head would have to move to Track 17 to find where the program resides on the disk, then go there. If it had to go back to Track 35, it would take 1.08 seconds for the head to get where it had to go and to pull off the program.

This doesn't sound like a lot of time, does it? When you're in a hurry, one second can seem like a century. Another example is the track-to-track time. If you initialize a new disk or try to make a backup, you might wait an extra three or four seconds.

One side of the diskette in Drive 0 becomes Drive 0, while the other side of the same diskette becomes Drive 2. One side of the diskette in Drive 1 becomes Drive 1, while the other side

Listing 1: CHARGER

```
10 DEFUSR1=&HE00
20 CLS
30 PRINT"DO YOU WISH TO CHANGE P
RINTER
40 INPUT"BAUD RATE (Y,N)";Q$
50 IF Q$="Y" THEN 80
60 IF Q$="N" THEN 250
70 GOTO 20
80 CLS
90 PRINT"PICK YOUR PRINTER BAUD"
100 PRINT"1) 300"
110 PRINT"2) 600"
120 PRINT"3) 1200"
130 PRINT"4) 2400"
140 PRINT"5) 4800"
150 INPUT"6) 9600";B
160 IF B=0 THEN 80
170 IF B=1 THEN POKE150,180
180 IF B=2 THEN POKE150,87
190 IF B=3 THEN POKE 150,41
200 IF B=4 THEN POKE150,18
210 IF B=5 THEN POKE150,7
220 IF B=6 THEN POKE150,1
230 IF B>6 THEN 80
240 DEF USR1=&HE00
250 CLS
260 PRINT"INPUT YOUR CHOICE"
270 PRINT"1) DS 6MS DRIVES
280 PRINT"2) DS 12 MS DRIVES
290 PRINT"3) SS 6MS DRIVES
300 INPUT"4) SS 12 MS DRIVES";K
310 IF K=0 THEN 250
320 IF K>4 THEN 250
330 ON K GOTO 340,350,360,370
340 LOADM"BOOT6":GOTO380
350 LOADM"BOOT":GOTO 380
360 LOADM"SSDC6":GOTO380
370 LOADM"SSDC":GOTO380
380 X=USR1(0)
```

Listing 2: SDC

```
0E00                00100       ORG     $0E00
0E00 CC    0E00     00110       LDD     #$E00
0E03 DD    72       00140       STD     $72
0E05 7F    DFFF     00150 START CLR     $DFFF    TEST IF IN ALL RAM MODE
0E08 86    AA       00160       LDA     #$AA
0E0A B7    DFFF     00170       STA     $DFFF
0E0D B1    DFFF     00180       CMPA    $DFFF
0E10 27    17       00190       BEQ     RAMODE   ALREADY IN RAM MODE
```

```
0E12 1A    50       00200          ORCC    #$50     DISABLE FIRQ+IR
0E14 8E    8000     00210          LDX     #$8000   POINT TO EXTENDED BASIC
0E17 EC    84       00220 LOOP     LDD     ,X       GET ROM DATA
0E19 7F    FFDF     00230          CLR     $FFDF    SET TO MAP TYPE 1
0E1C ED    81       00240          STD     ,X++     SAVE ROM DATA TO RAM MIRROR
0E1E 7F    FFDE     00250          CLR     $FFDE    SELECT ROM MAP TYPE 0
0E21 8C    DEFF     00260          CMPX    #$DEFF   END OF ROM ?
0E24 25    F1       00270          BCS     LOOP
0E26 7F    FFDF     00280          CLR     $FFDF    YES..CHANGE TO ALL RAM MODE
0E29 CC    2B2B     00290 RAMODE   LDD     #$2B2B   NEW PROMPT SYMBOL
0E2C FD    ABEE     00300          STD     $ABEE    MODIFY BASIC 'OK'
0E2F 86    30       00310          LDA     #$30
0E31 B1    C142     00320          CMPA    $C142    DOS VERSION 1.0
0E34 27    17       00330          BEQ     DOS
0E36 8D    4C       00340          BSR     CLEAR    CLEAR SCREEN
0E38 CC    0014     00350          LDD     #$0014   6 MS. RESTORE AND HOME
0E3B B7    D7C0     00360          STA     $D7C0    $0015 FOR 12 MS.
0E3E F7    D816     00370          STB     $D816
0E41 CC    4142     00380          LDD     #$4142   FOR DOUBLE SIDED DRIVES
0E44 FD    D89F     00390          STD     $D89F
0E47 108E C139     00400          LDY     #$C139
0E4B 20    11       00410          BRA     MOD
0E4D 8D    35       00420 DOS      BSR     CLEAR    CLEAR SCREEN
0E4F CC    0014     00430          LDD     #$0014   6 MS. RESTORE
0E52 B7    D6CD     00440          STA     $D6CD
0E55 F7    D723     00450          STB     $D723    FOR DOS VERSION 1.0
0E58 CC    4142     00460          LDD     #$4142   DOUBLE SIDED DRIVES
0E5B FD    D7AC     00470          STD     $D7AC
0E5E 30    8D 0033  00480 MOD      LEAX    TABLE,PCR        GET MESSAGE BEG. ADDR.
0E62 86    0D       00490          LDA     #$0D     CARRIGE RETURN CODE
0E64 8D    2B       00500 MODA     BSR     OUTCH    OUTPUT CR
0E66 A6    80       00510 MOD1     LDA     ,X+      OUTPUT MESSAGE
0E68 81    04       00520          CMPA    #4       END OF MESSAGE ?
0E6A 27    02       00530          BEQ     END      YES
0E6C 20    F6       00540          BRA     MODA     NO
0E6E 0F    E3       00550 END      CLR     $E3      SETUP FOR AUTO RESTART
0E70 0F    E4       00560          CLR     $E4      AFTER RESET IS PUSHED
0E72 B6    FF03     00570          LDA     $FF03
0E75 8A    01       00580          ORA     #1
0E77 B7    FF03     00590          STA     $FF03
0E7A 0F    6F       00600          CLR     $6F      IRQ DISABLE
0E7C BD    AD33     00610          JSR     $AD33    RESET STACK
0E7F 1C    AF       00620          ANDCC   #$AF
0E81 7E    AC73     00630          JMP     $AC73    RESTART BASIC
0E84 8E    0400     00640 CLEAR    LDX     #$400    BEGINNING OF DISPLAY
0E87 86    60       00650          LDA     #$60     SPACE CODE
0E89 A7    80       00660 CLEAR1   STA     ,X+      PUT SPACES IN THE DISPLAY
0E8B 8C    0600     00670          CMPX    #$600    END OF DISPLAY ?
0E8E 26    F9       00680          BNE     CLEAR1   NO
0E90 39             00690          RTS     RETURN
0E91 6E    9F A002  00700 OUTCH    JMP     [$A002] BASIC OUTPUT
0E95       4D       00710 TABLE    FCC     "MICRO-CONNECTION "
0EA6       20       00720          FCC     "  1985 "
0EAD       0D       00730          FCB     $0D
0EAE       42       00740          FCC     "BY D.K.BIRONAS "
0EBD       0D       00750          FCB     $0D
0EBE       52       00760          FCC     "RR# 2 "
0EC4       0D       00770          FCB     $0D
0EC5       46       00780          FCC     "FRANKFORT, INDIANA"
0ED7       20       00790          FCC     " 46041 "
0EDE       0D       00800          FCB     $0D
0EDF       0D       00810          FCB     $0D
0EE0       53       00820          FCC     "SUPER-DISK"
0EEA       0D       00830          FCB     $0D
0EEB       43       00840          FCC     "CHARGER 1.3"
0EF6       0D       00850          FCB     $0D
0EF7       04       00860          FCB     4
           0000     00870          END

00000 TOTAL ERRORS
```

of the same diskette becomes Drive 3. Try this: Put a diskette with programs on it in Drive 0 and type in `DSKINI2`. After the formatting is complete, type in `BACKUP 0 TO 2`. Now, do a `DIR0` THEN `DIR2`. Got the idea? The bottom line is that the other side of the diskette becomes another drive number.

One last thought to consider: You should realize a marked decrease in disk drive mechanically generated noise; most of the noise is generated from the head drive mechanism. You should use your disk drive at or near its speed capability — they will last longer.

By the way, you can permanently change your step rate by comparing the old DOS with the *CHARGED* DOS and making the changes in EPROM. That is perfectly legal for you to do, but not for me to do for you.

My system has none of the original ROMs, as I have changed each ROM so my system is automatically configured on "power up." It really gets to be a pain when you have to do several PEEKs and POKEs every time you power down.

Let me know how useful this program is to you. Drop me a line and let me know what else you are interested in. I will only consider serious software suggestions.

I also have a double-sided, plated through holes, gold plated edge connector EPROM programmer circuit board with software for $30 plus postage. It will cost you about another $30 for the parts to build it. For information on the programmer, send $2 to:

Dennis Bironas
R.R. #2
Frankfort, IN 46041

The programmers can be built (cutting runners) to program 2764s. With no modifications, it will program 2716s, 2732s, 2532s and 2564s. The programmer will work with all models of CoCos when nine volt batteries are used as the programming supply.

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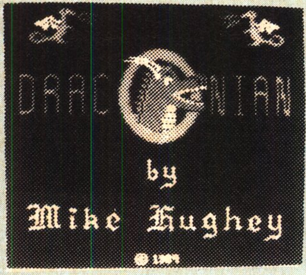
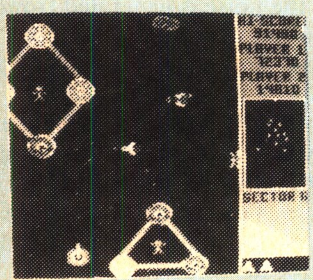




DRACONIAN

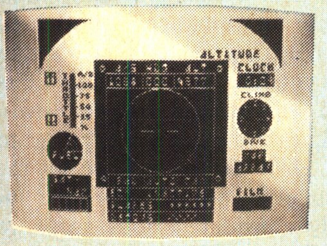
You brace yourself as your ship materializes in the enemy sector. Your engine roars to life, and you consult the long-range scanner for the position of the nearest enemy base. As you head for the base, blasting asteroids and space-mines in your path, you suddenly notice a monstrous space-dragon looming before you. Reacting quickly, you dodge his deadly fire-breath and blast him out of existence.

This is it — the single most impressive, awe-inspiring arcade game you can buy for your Color Computer. High-resolution graphics, awesome sound effects, four-voice music, and quality you have to see to believe! Experience the realism of DRACONIAN today!

JOYSTICKS REQUIRED

32K MACHINE LANGUAGE

TAPE $27.95 DISK $30.95



SR-71

SR-71 is a fast action game in which you are the pilot on a mission to take photographs of missile sites in Russia and deliver them to our processing laboratory in Japan. So real you will feel as if you are in the cockpit on a real spy mission. Elude Russian missiles as well as their detection devices. Another Tom Mix exclusive. A must for the adventurous. Fantastic graphics, color and sound. **32K Ext. Basic.**

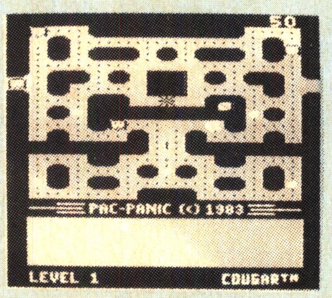
TAPE $28.95 DISK $31.95

PAK-PANIC

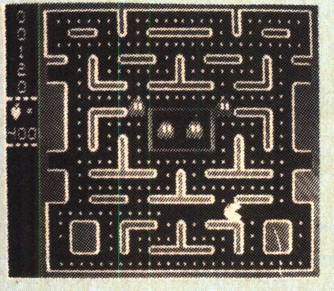
Pakman is steered thru a maze eating dots and powerpills. Pakman is pursued by four monsters who try to catch and kill him. If Pakman eats a powerpill he becomes powerful and can eat monsters. Monsters try to avoid a powerful Pakman. As monsters are eaten their ghosts appear on the top of the screen. When seven ghosts have appeared one will fly across the screen or they will link together forming a centipede that will travel thru the maze. Pakman has no power against ghosts and centipedes and must avoid them or be killed. **JOYSTICKS REQUIRED**

32K MACHINE LANGUAGE

TAPE $24.95 DISK $27.95



BOTH MS. MAZE & PAK PANIC ONLY 44.90 TAPE, 50.90 DISK



MS. MAZE

MS. MAZE is remarkable in that it combines brilliant color, high resolution, detailed graphics, and music with a very playable game. Anything that could be done to make the Color Computer look and play like the arcade version has been done. MS. MAZE is without question the closest thing to the arcade Pac games that I have seen for the Coco.

JOYSTICKS REQUIRED

32K MACHINE LANGUAGE

TAPE $24.95 DISK $27.95

New From Tom Mix

Worlds of Flight

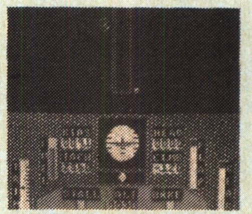
Not A Game — A Very Realistic Flight Simulation

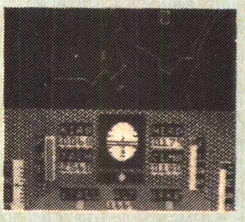
WORLDS OF FLIGHT (WOF) is a "view" oriented flight simulation for the TRS-80 Color Computer, written entirely in Machine Language. "View" oriented means that the pilot may determine his or her position by actually viewing the surrounding landmarks as opposed to using instruments which sense navigational references. This is a major departure from "instrument only" simulations which can be achieved through BASIC programs. Most instrument maneuvers and procedures may be practiced. The craft is a light-weight, single-engine airplane with low wings. A nose wheel which is both steerable and retractable is also modeled. Some aerobatics are possible including sustained inverted flight, aileron rolls, spins and stalls.

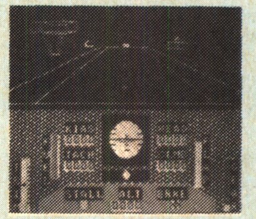
JOYSTICKS REQUIRED

32K MACHINE LANGUAGE

TAPE $29.95 DISK $32.95







ANNOUNCING!

The SAILOR MAN

3 Screens-Plus-"INVISO SCREEN"

The First 64K Arcade Game For the Color Computer

The first screen objective is to catch enough of Elsie's kisses (those Red Heart Shaped Things) to fill in the squares on the Sailorman's house. If you can time your punch just so, you can send the punching bag over to knock the bucket down and, with a little bit of luck, right onto **Bigfatbadguy's** head. This will give you a little (but not much) time to catch all those RHSTs.

You must avoid contact with **Bigfatbadguy** who is actively pursuing you. You must also be careful of **Olduglyseawoman** who will appear at higher difficulty levels to chuck empties at you. Either avoid the flying bottles or punch them (with the fire button) to keep from being knocked into the water.

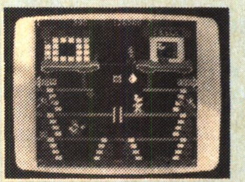
The second screen objective is to collect enough notes to play Elsie a little love song. You may jump off and onto the other end of **Fatguyeatingahamburger's** teetertotter to fly up a deck and even two decks if you manage to catch hold of **Smartaleckkid's** grab handles. Time it right and away you go.

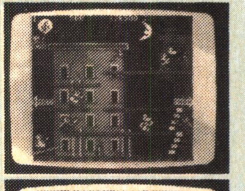
The Third screen objective is to collect enough letters (thrown by Elsie's cries for H-E-L-P) to complete a ladder all the way to the crow's nest where Elsie is calling you. Beware of the Crow, however, who thinks you are after her eggs!

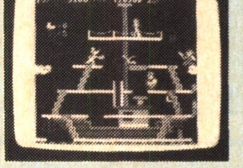
On all screens, eating a can of **collard greens** (labeled "S" for Collard and grasped by punching the can just right) will give you amazing speed, strength and agility and allow you to send **Bigfatbadguy** into the drink with a single punch.

REQUIRES 64K

DISK **$34.95** TAPE **$29.95**







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16K Extended basic/32K for printer output

The Vocabulary Management System (VMS) is a series of programs designed to aid a parent or teacher in helping children to learn and practice using vocabulary and spelling words. The 11 programs that comprise the VMS include a full feature data entry/edit program, three printer output programs and 5 vocabulary/spelling game programs. The system's many outstanding features include:

—As many as 300 vocabulary words and definitions may be in the computer's memory at one time.

—Words and definitions may be saved on disk or tape.

—Remarks and/or comments can be saved with word files.

—A disk loading menu allows students to load disk files without typing file names.

—Word lists may be quickly alphabetized.

—The three printer segments allow you to create and print individualized tests, puzzles, word-searches and worksheets.

TAPE $39.95 DISK $42.95

—The printer segments allow full use of your printer's special features.

—The 5 game programs are based on sound educational principles and provide practice in identifying words and matching them with their definitions in a fast-paced set of activities.

FRACTIONS - A Three Program Package - 32 K EXT. BASIC TAPE $30.95 DISK $35.95

MIXED & IMPROPER

1. Review converting mixed numerals and improper fractions.
2. Practice converting mixed numerals to improper fractions.
3. Practice converting improper fractions to mixed numerals.
4. Practice of both types. (Mixed to improper & improper to mixed)
5. Review converting mixed numerals to mixed numerals. (Used in regrouping in substraction)
6. Practice converting mixed numerals to mixed numerals.

EQUIVALENCE

1. Definitions of terms and review of finding equivalent fractions.
2. Practice finding equivalent fractions.
3. Practice finding sets of equivalent fractions.
4. Review of finding if one fraction is equal to, not equal to, less than or greater than another.
5. Practice finding if one fraction is equal to, not equal to, less than or greater than another.

LOWEST TERMS

1. Review of placing fractions into lowest terms by finding the greatest common factor (GCF) of the numerator and denominator.
2. Practice finding the GCF of pairs of numbers.
3. Practice placing fractions into lowest terms by finding the GCF of the numerator and denominator.

TEACHER'S DATABASE

TEACHER'S DATABASE is a program designed to allow a teacher to keep a computerized file of information about his/her students. There are many features that make this program particularly attractive:

- Information on as many as 100 students (or more) may be in the computer at one time.
- Each student may have as many as 20 (or more) individual items of data in his/her record.
- The program will run from cassette or disk.
- Cassette and disk files are completely compatible.
- The program is menu driven.
- Records may be easily changed, deleted, combined or added.
- Information about students may be numerical or text.
- Records may be quickly alphabetized.
- Records may be sorted by various criteria.
- Records may be reordered (ranked) based on test scores or other data.
- Data displayed during a sort may be printed on a printer or saved on disk or cassette as a new file.
- A full statistical analysis of data may be done and sent to the printer.
- Student test scores may be weighted.

REQUIRES 32K EXT. BASIC
TAPE $39.95 DISK $42.95

MATH DUEL

MATH DUEL is a challenging mathematics game that pits you against the computer it a game of wits. You must use all of your knowledge of factors, multiples and prime numbers to develop a strategy that allows you to gather more numbers and thus more points that than the computer.

The game is deceptively simple. You select the size of the playing field that is composed of from 8 to 100 numbers. You must then choose numbers that will give you the maximum number of points and the computer the least number of points. There are only 6 rules.

1. Any number that you chose must have at least one factor still on the playing field.
2. You receive points equal to the face value of the number that you chose.
3. The computer receives points equal to the face value of all of the remaining factors of the number that you chose.
4. All of the numbers that were awarded to you or to the computer are removed from the field.
5. The game continues until there are no numbers with factors remaining.
6. At the end the computer receives points equal to the value of all of the remaining numbers.

32K EXT. BASIC **TAPE $24.95** **DISK $29.95**

ESTIMATE

ESTIMATE is a program designed to help children to practice estimating the answers to addition, subtraction, multiplication and division problems on the Color Computer. it has many features that make its use particularly attractive.

- Up to 5 students may use the program at the same time.
- There are 5, user modifiable, skill levels.
- The acceptable percent error may be changed as a student's skill improves.
- A timer measures the number of seconds used to answer each problem and the total time used for a series of problems.
- If a problem has been answered incorrectly, the student is told the percent error and asked to try again.
- If a problem is answered incorrectly a second time, the student is told the correct answer and the range of acceptable answers is displayed.
- A report is given at the end of each set of problems that includes the number of problems done, the number of problems answered correctly on the first try and the average percent error.
- The (BREAK) key has been disabled so that child will not inadvertently stop the program from running. **REQUIRES 16K EXT. BASIC**

TAPE $19.95 DISK $22.95

PRE-ALGEBRA I INTEGERS

INTEGERS is a series of four programs designed to give students practice in working with addition, subtraction, multiplication, division and the comparison of integers. It has many features that make a very valuable tool for introducing and/or maintaining skills.

- Up to 4 students may use the program at the same time.
- There are 9, user modifiable, skill levels.
- Students are given two opportunities to answer a problem.
- A detailed report of student performance, including number correct on first try, number wrong, total time used and percentage score, is presented at the end of a series of problems.
- The programs will run on a 16K TRS-80 Color Computer with or without disk drive.

Four distinct problem formats are presented. The first presents problems in this format: – 12 + – 9 = ? The second program presents a problem with missing numerals in this format: – 7 – ? = 18. The third program presents a problem with a missing sign: 8 – ?6 = 14. The last program asks the student to determine the relationship (=, ◄ or ►) between two statements 3 – 9 (??) – 4 – 5.

32K EXT. BASIC
TAPE $28.95 DISK $33.95

PRE-ALGEBRA II

The second **PRE-ALGEBRA PACK** is composed of two programs, EQUATION SOLVER AND EQUATION DUEL, that are designed to give students practice in using and solving equations. It has many features that make a very valuable tool for introducing and/or maintaining skills:

- In both programs students may choose the range of numerical values that will be included in the equations so that the difficulty may change as their skill increases.
- In EQUATION SOLVER the computer secretely generates a random equation, shows the numbers that it used in the equation and the answer and challenges the student to create his/her own equation that uses the same numbers and results in the same answer.
- In EQUATION DUEL the student and the computer race to see who will be the first to create an equation from the same set of random numbers.
- Both programs give detailed reports of the student's and the computer's performance in creating and solving equations including time used, score and percentage correct.

32K EXT. BASIC
TAPE $28.95 DISK $33.95

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PIPELINE

COMPUTER EXECS? — The technology of artificial intelligence has taken computers "beyond sophisticated number crunching to participation in management decisions," according to a spokesman for Litton, a California-based company that develops electronics and defense systems.

Appearing before the Houston Society of Financial Analysts, Sy Schoen, the manager of Litton's artificial intelligence program, said that he foresees applications in marketing, planning, production management, customer service, and in further automating a company's facilities.

Currently under development at Litton are programs in image analysis to aid experts in studying surveillance photographs, and the enhancement of radar identification of multiple aircraft.

* * *

FLEXING AGAIN — Frank Hogg Laboratory (FHL) and Technical Systems Consultants (TSC) have entered into an agreement making FHL a nationwide distributor of TSC's FLEX-based software.

Now available through FHL dealers are such programs as: *68000 Cross Assembler, Text Editor, Pascal, X-BASIC* and *Diagnostics* for 6809.

* * *

SOFTWARE ON VIDEO TAPE — Creative Technical Consultants (CTC) has introduced a catalog/video tape of CoCo products for teachers which make it possible for them to preview educational software. The tape takes the instructor through each program as a student would see it — from the title screen, through the menu, over some sample problems, and finally to the scoring and reward displays.

CTC says the video tape solves the preview privilege vs. piracy software problem the company has encountered in the past since all of its educational programs are written in BASIC. Teachers may preview the programs at no charge; the tape must be returned in 30 days. Write to 166 Sangre de Cristo, P.O. Box 652, Cedar Crest, NM 87008.

* * *

TESTING, TESTING — The International Bureau of Software Test has expanded its services to include "quality assurance services" for technical manuscripts. Their service is designed to accommodate publishers of computer books and manufacturers of software. The company is an affilitate of Prentice-Hall. Write to 165 Forest Street, Marlboro, MA 01752.

* * *

GETTING ORGANIZED — Buddy Systems has introduced Paper Catcher, a unique solution for handling continuous forms generated by computer printers. With the new product, printed pages stack neatly on top of the printer.

Paper Catcher requires no more space than the printer itself and will neatly refold and stack checks, pages, labels and any continuous forms. It has vinyl "feet" for added stability, and does not interfere with the printer operation in any way.

Write to Buddy Products, 1350 South Leavitt Street, Chicago, IL 60608.

* * *

FREEBIES — Because of an advertising ommission due to an oversight at RAINBOW, Ross Litton wants us to pass along a reminder that free printer tutorials are still available with the purchase of the Epson RX-80FT+ from Howard Medical Computers.

With the purchase of any monitor from Howard, you get free reverse video capabilities. The company recently expanded its line of monitors to include the 141 Roland 14-inch Color Monitor with sound and 270 x 270 dot resolution.

* * *

THE WORD — A new line of Biblical software for use with church groups has been introduced by Manna Computing Concepts. In its catalog, Manna notes that personal computers are becoming major channels of information in society. "Already, we see many software programs with definite themes of witchcraft, violence and death," note the owners in their most recent catalog. Manna hopes to reinforce traditional values through fun, educational programs.

To provide encouragement to the developers of such software, Manna encloses a response card in each package asking the user to provide feedback. The responses will be published in Manna's next catalog. Write: P.O. Box 527, Woodstock, GA 30188.

* * *

ALL YOU EVER WANTED TO KNOW — Anchor Automation has published an eight-page *Guide to Modems*, which is available free to consumers through participating retail outlets.

The pamphlet includes definitions of terms, along with explanations of operation principles, how Baud rates are determined, various tips on increased efficiency, and advice on software, installation and troubleshooting.

Dealer requests should be addressed to: Anchor Automation, Inc., 6913 Valjean Avenue, Van Nuys, CA 91406.

* * *

FUNDING SOURCE — Need help funding computer education at your school? Career Publishing, Inc. is sponsoring a $500,000 program to provide computer courseware and training for elementary, secondary and post-secondary teachers and administrators.

A grant entitles the recipient to offer qualified instructors a workshop in the methods and techniques required to effectively teach others to use computers as problem-solving tools, develop and enhance critical thinking skills, teach computer literacy applications and develop "Information Age" employment skills.

Write to Career Publishing, Inc., 910 North Main Street, Orange, CA 92667.

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CoCo Memory Map	$12.00
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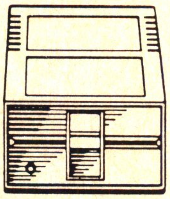

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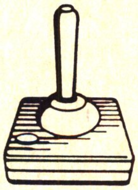

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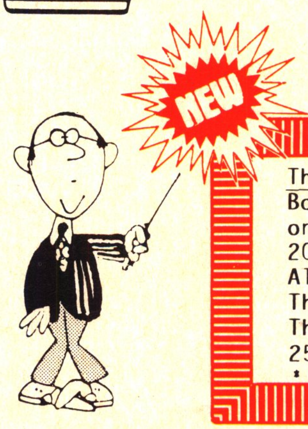

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More Patches For EDTASM

By W.C. Clements, Jr.

Disk *EDTASM+* is an extremely powerful package. In some ways, it is a major improvement over the old cartridge program. The program disk holds two versions: regular *EDTASM,* which works much like the original program, and an overlay version that frees memory by reading in, or "overlaying," sections of the code as they are needed rather than keeping the whole thing in memory at once.

The overlay version is especially valuable to the serious machine language programmer because it allows the source file to be broken up into several separate units for editing and storage to disk. They can then be assembled together using the INCLUDE command. I have used this feature to assemble, in a single pass, source files that total more than 2100 lines; try that with a run-of-the-mill editor/assembler!

Roger Schrag has written several articles in THE RAINBOW that presented some very useful patches for the original, cassette-based version of *EDTASM+*. Those modifications gave CoCo owners a fine disk-oriented, program-development tool even before Radio Shack brought out their Disk *EDTASM+*, and many readers, including myself, have benefited greatly from Schrag's work.

An irritating feature of all versions of *EDTASM+* has always been the relentless one-byte-per-line listing of the ASCII equivalents of each character in every FCC (Form Character Code) string. That listing wastes considerable paper when printing an assembly, and gives little or no useful information.

Big jobs especially tend to have lots of prompts or other titled output, for which the original operation of the FCC pseudo-op effectively discourages getting a printed listing at all. Schrag fixed this "FCC bug" in the original *EDTASM+* by poking an RTS op code into the routine that printed those bytes (see the March 1984 RAINBOW for his fix, Page 160).

Radio Shack and Microsoft didn't fix the "FCC bug" when they brought out the newer Disk *EDTASM+*, unfortunately. I'll give you the proper locations to insert Schrag's fix for the regular file (named *EDTASM*) and also for the overlay version (*EDTASMOV*), both of which are part of the Disk *EDTASM+* package from Radio Shack.

To fix the FCC bug, first place the program disk in your drive, type `LOADM "EDTASM"` and ENTER. Then type `POKE &H3C04,&H39`, ENTER and save the file back to another formatted disk using `SAVEM "EDTASM",&H1600,&H4A7F,&H1600` ENTER. The procedure to fix the overlay version is similar: `LOADM "EDTASMOV"` and ENTER; `POKE &H4048,&H39` and ENTER; `SAVEM "EDTASMOV",&H1600,&H517F,&H1600` and ENTER.

These modifications have made Disk *EDTASM+* a far greater pleasure to use for all sizes of jobs. Thanks to Roger Schrag for inspiring the fixes listed here. They've saved me a good half-box of paper over the last year.

(Any questions about these modifications may be directed to Mr. Clements at P.O. Box 2662, University, AL 35486, phone (205) 348-6450.)

(Dr. Bill Clements, a professor of chemical engineering at the University of Alabama, designs peripherals and programs for his department's student computer facility (all CoCos). His major interests are in process control and microcomputer applications.)

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To help celebrate Spectrum Projects Fourth year in supporting the CoCo, we are offering a truly unbelievable once in a lifetime deal! Buy any software from our 2 page "Colorful Utilities" ad and get a set of (8) 64K CoCo chips for only $14.95! Offer is limited to one set per customer and expires 07/10/85. Order now as quantities are limited!

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The best screen dump program for the Epson & Gemini printers ever! Have the option of standard or reverse images w/regular or double sized pictures. 600-9600 Baud too! A must for Graphicom and Bjork Block users. 16K TAPE/DISK **$19.95** (see Nov '84 Rainbow Review)

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A multi-featured tool for USER FRIENDLY disk handling. Utilize a directory window to selectively sort, move, rename and kill file entries. Lightning fast Disk I/O for format, copy and backup. Examine contents of files, the Granule Table, plus the size, load addresses and entry points of all programs. Single command execution of both Basic and ML programs. 32K/64K Disk **$24.95** (see Oct '84 Rainbow Review)

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A text designer/editor to generate graphics mode lettering with multiple font sizes, textures, shadowing and thicknesses, plus special patterns for creative backgrounds. Comes with a screen print routine and Letter Head Utility that interfaces with Telewriter-64 and BASIC. DISK **$29.95** (see July '84 Rainbow Review)

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Add 24 NEW disk commands with 2 Hi-Res screens! Supports 40 track & Double-Sided drives, fast stepping rates, auto disk search, line numbering, error trapping & "EPROMABLE". 64K DISK **$49.95**

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Save time and design pro looking diagrams using a 480X540 pixel worksheet w/6 viewing windows. Over 30 electronic symbols w/10 definable symbols. Print hard copy and save to disk. 64K DISK ~~$49.95~~ New LOW price!!! **$29.95** (see Jan '84 Rainbow Review)

COLORAMA

A first-class Bulletin Board package... especially geared towards CoCo users... has an ordering section for those who want to run a mail-order business... supports Color Graphics... one nice piece of work. 64K DISK **$99.95** July '84 Rainbow. NEW! COLORAMA BBS Time Module **$59.95**

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Use your CoCo to keep track of your checking and savings accounts! Printout individual personal checks! 32K/64K TAPE **$29.95** DISK **$39.95** (see April '85 Rainbow Review)

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COLORFUL UTILITIES

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Start your VCR tapes with dazzling title frames followed by professional countdown to black fade-outs! 16K TAPE **$19.95**

NEW!

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Autostart your Basic/ML programs with impressive title screens using a mixture of text and graphics! 16K TAPE **$19.95** (see June '85 Rainbow Review)

64K DISK UTILITY PACKAGE

Take advantage of an expanded 64K machine. Make an additional 8K of RAM available. Copy ROM cartridges to disk and create a 32K SPOOL buffer for printing. DISK **$21.95** (see July '83 Rainbow Review)

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A powerful package that transfers tape to disk and disk to tape automatically. Does an automatic copy of an entire disk of programs to tape. Ideal for Rainbow On Tape to disk. TAPE/DISK **$24.95** (see Sept '83 Rainbow Review)

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Save and load cassette files at twice the speed! Now you can run tape and printer I/O operations in the high speed mode without a locked up system or I/O ERRORS! "If you are tired of waiting for those long tapes to load, I strongly recommend that you buy this fine utility." TAPE **$21.95** July '83 Rainbow

GRAPHICOM

The ultimate CoCo graphics development tool with sophisticated editing, preview animation, telecommunications and printer support. Hi-Res graphics for only **$24.95.** W/Spectrum's Menu Foot Switch **$34.95** or W/Spectrum's Graphicom Joystick **$49.95.** 64K DISK (see April '84 Rainbow Review)

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A Hi-Res graphics casino blackjack simulation and card counting tutor. Fully realistic play includes: double down, splits, surrender, insurance bets, 1-8 decks, burnt cards, shuffle frequency and more! "This fine program is a must for the CoCo Blackjack player." (Aug '83 Rainbow Review) 32K TAPE/DISK **$24.95** (also see Dec '84 Rainbow Review)

All orders plus $3.00 S/H (Foreign $5.00) – COD add $2.00 extra – NYS Residents add Sales Tax

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Accepts composite video signal in (1.0v p-p) from video camera, VCR, video disc player, another computer, or other compatible video sources.

View "off air" or "VCR" digitized video at close to real-time. "Snapshot" video frames to the digitizer's internal memory. No slow, "blurry" serial manipulation ... just hit your joystick's fire button! It's that simple.

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Video is input via a "BNC" connector. External controls for HORIZONTAL POSITION, VERTICAL POSITION, HORIZONTAL WIDTH, BRIGHTNESS, and CONTRAST (FUZZ) settings.

Don't be fooled by imitations... this is the GRAPHICOM **VIDEO DIGITIZER** ... the **only** digitizer that "DIRECTLY" inputs into Graphicom (The original design by Cheshire Cat, the folks that brought Graphicom to the COCO world)

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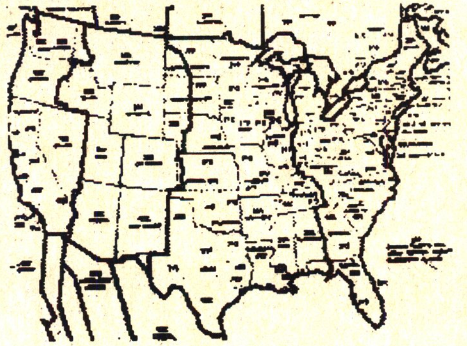
$199.95



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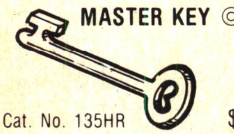

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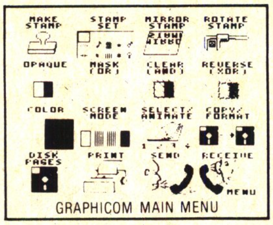
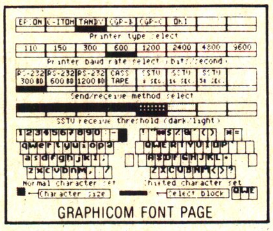
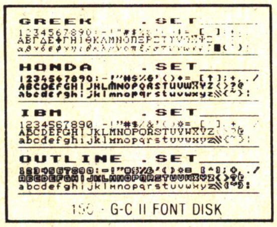


GRAPHICOM MAIN MENU



GRAPHICOM FONT PAGE

12C - ART DEMO FROM WHITESMITH



15C - G-C II FONT DISK

GRAPHICOM $24.95

Simply stated - One of the finest graphic programs written for the Color Computer!

FEATURES

- U-S-E-R F-R-I-E-N-D-L-Y!
- 4 Display modes (Including Hi-Res red/blue artifact)
- Animate mode
- Color Palette with over 15 color patterns for use with Hi-Res artifact
- Send/Receive pictures over standard modem at 300, 600, or 1200 baud
- Supplied utility allows capturing Hi-Res screens from most COCO arcade games (even protected ones)
- Multiple Hi-Res character fonts (user redefinable)
- Supplied utility for transferring Graphicom screens to Basic or other M/L programs
- Supplied utility for loading screens from Basic or other sources
- Built in Hi-Res SCREEN PRINT (compatible with EPSON, C-ITOH, GEMINI-10, OKI, plus Radio Shack's LP-VII, LP-VIII, DMP-100, DMP-200, and GCP-115 printers) from 110 to 9600 baud
- Slow-scan television SEND/RECEIVE options
- Many additional features, operating hints, hardware mod's and suggestions, etc.

★ EASY TO LEARN GRAPHIC MENU ★
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PICTURE DISKS $9.95

Available from COMPUTIZE

4C - Artifact color palette
5C - Large character sets drawn with master design (from Derringer Software)
6C - Same as 5C but set up as stamp set
7 - Miscellaneous Art Set #1
8 - Miscellaneous Art Set #2
9 - Miscellaneous Ads and Examples
10 - Miscellaneous Fonts
11C - Artifact color palette type fonts

12C - Art demo from WHITESMITH
Color Hi-res artworks from Whitesmith, the people that brought you Graphicom Part][, introduced by an animated marching band performing a Sousa march in 4-part harmony!

13C - GRAPHICOM PART II function demo

☞ GCII FONT DISKS

Each disk contains 40 or more font files (10 or more GRAPHICOM PART][fonts, 4 versions of each, one for each display mode), and three "FONT INDEX" screens to make identification and selection easy.

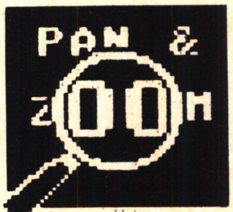
14C - GCII Fonts Disk #1
15C - GCII Fonts Disk #2
16C - GCII Fonts Disk #3

DISK
SLIDE
PAN & ZOOM
GRAPHICOM PART II
COPY
PAINT

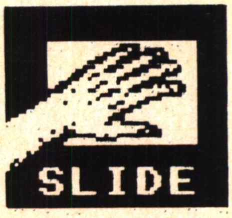
©1984 WHITESMITH V:1.0

GRAPHICOM PART][is a menu-driven graphics utility that does not require the original GRAPHICOM to run. It includes many of the functions that are missing in GRAPHICOM and will load and save both STANDARD (binary) and GRAPHICOM format screens. GRAPHICOM PART][requires a 64K Color Computer or Color Computer II, and at least one disk drive, It supports 1 to 4 disk drives, keyboard or joystick input, COLOR or B/W (hi-res) operation, and 4 screen display modes. "OOPS" command provides recovery after mistakes, and allows experimenting. Supplied on disk with a 34 page manual.

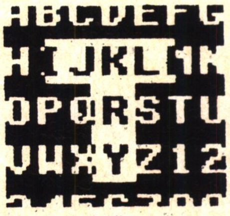
GRAPHICOM PART II-$24.95



See your screens magnified 2x, 4x, or 8x! Draw or "touch up" in either color or B/W (hi-res) mode. Excellent for fine detail work.



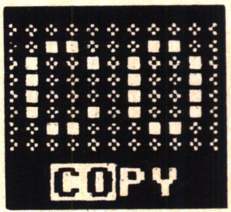
Reposition graphics with precision and ease. "WRAP-AROUND" feature prevents graphics from scrolling off the edge of the screen.



Add type in 16 different sizes, over 50 colors of text, characters may be rotated or mirrored to allow typing in almost any direction.

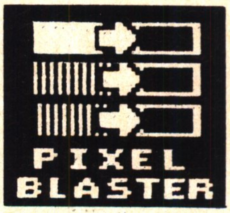
ROTATE
ENLARGE
REDUCE

Enlarge or reduce any part of a screen by any amount, proportional or nonproportional. Rotation can be anything from 0 to 359 deg.

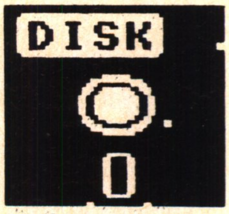


Reproduce and enlarge small areas of the screen with icons or patterns for backgrounds, logos, etc. Over 80 icons supplied on disk (also user-defineable).

More than 50 different colored shades and patterns available (over 200 if you count the 4 display modes...) Additional patterns may be user defined!



Substitute colors, swap BLUE and RED, remove WHITE (removing all color widens lines for painting!), create color separations.



Load & save screens in either GRAPHICOM or STANDARD format, copy screens from one format to another. Supports single or multiple (up to 4) disk drive system.

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RAINBOW Info

How To Read Rainbow

Please note that all the BASIC program listings you will find in THE RAINBOW are formatted for a 32-character screen — so they will show up just as they do on your CoCo screen. One easy way to check on the accuracy of your typing is to compare what character "goes under" what. If the characters match — and your line endings come out the same — you have a pretty good way of knowing that your typing is accurate.

We also have "key boxes" to show you the *minimum* system a program needs. But, *do* read the text before you start typing.

Finally, the little cassette symbol on listings indicates that program is available through our RAINBOW ON TAPE service. An order form for this service is on the insert card bound in the magazine.

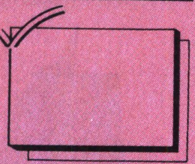
What's A CoCo

CoCo is an affectionate name which was first given to the TRS-80 Color Computer by its many fans, users and owners. As such, it is almost a generic term for three computers, all of which are very much alike.

When we use the term CoCo, we refer to the TRS-80 Color Computer, the TDP System-100 Computer and the Dragon-32 Computer. It is easier than using the three "given" names throughout THE RAINBOW.

In most cases, when a specific computer is mentioned, the application is for that specific computer. However, since the TDP System-100 and TRS-80 Color are, for all purposes, the same computer in a different case, these terms are almost always interchangeable.

The Rainbow Check Plus



The small boxes that you see accompanying programs in the THE RAINBOW are the "Check system," which is designed to help you type in programs accurately.

Rainbow Check PLUS will count the number and values of characters you type in. You can then compare the number you get to those printed in THE RAINBOW. On longer programs, some benchmark lines are given. When you reach the end of one of those lines with your typing, simply check to see if the numbers match.

To use the *Rainbow Check PLUS,* type in the program and CSAVE it for later use, then type in the command RUN and press ENTER. Once the program has run, type NEW ENTER to remove it from the area where the program you're typing in will go.

Now, whenever you press the down arrow key, your CoCo will give you the checksum based on the length and content of the program in memory. This is to check against the numbers printed in THE RAINBOW. If your number is different, check the listing carefully to be sure that you typed in the correct BASIC program code. For more details on this helpful utility, refer to H. Allen Curtis' article on Page 21 of the February 1984 RAINBOW.

Since *Rainbow Check PLUS* counts spaces and punctuation, be sure to type in the listing exactly the way it's given in the magazine.

```
10 CLS:X=256*PEEK(35)+178
20 CLEAR 25,X-1
30 X=256*PEEK (35)+178
40 FOR Z=X TO X+77
50 READ Y:W=W+Y:PRINT Z,Y;W
60 POKE Z,Y:NEXT
70 IFW=7985THEN80ELSEPRINT
   "DATA ERROR":STOP
80 EXEC X:END
90 DATA 182, 1, 106, 167, 140, 60, 134
100 DATA 126, 183, 1, 106, 190, 1, 107
110 DATA 175, 140, 50, 48, 140, 4, 191
120 DATA 1, 107, 57, 129, 10, 38, 38
130 DATA 52, 22, 79, 158, 25, 230, 129
140 DATA 39, 12, 171, 128, 171, 128
150 DATA 230, 132, 38, 250, 48, 1, 32
160 DATA 240, 183, 2, 222, 48, 140, 14
170 DATA 159, 166, 166, 132, 28, 254
180 DATA 189, 173, 198, 53, 22, 126, 0
190 DATA 0, 135, 255, 134, 40, 55
200 DATA 51, 52, 41, 0
```

Using Machine Language

Machine Language programs are one of the features of THE RAINBOW. There are a number of ways to "get" these programs into memory so that you can operate them.

The easiest way is by using an Editor-Assembler, a program you can purchase from a number of sources.

An editor-assembler allows you to enter mnemonics into your CoCo and then have the editor-assembler assemble them into specific instructions that are understood by the 6809 chip that controls your computer.

When you use an editor-assembler, all you have to do, essentially, is copy the relevant instructions from THE RAINBOW'S listing into CoCo.

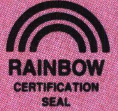
Another method of getting an assembly language listing into CoCo is called "hand assembly." As the name implies, you do the assembly by hand. This can *sometimes* cause problems when you have to set up an ORIGIN statement or an EQUATE. In short, you have to know something about assembly to hand assemble some programs.

Use the following program if you wish to hand assemble machine language listings:

```
10 CLEAR200,&H3F00:I=&H3F80
20 PRINT "ADDRESS:";HEX$(I);
30 INPUT "BYTE";B$
40 POKE I,VAL("&H"+B$)
50 I=I+1:GOTO 20
```

This program assumes you have a 16K CoCo. If you have 32K, change the &H3F00 in Line 10 to &H7F00.

The Rainbow Seal



The Rainbow Certification Seal is our way of helping you, the consumer. The purpose of the Seal is to certify to you that any product which carries the Seal has been physically seen by us and that it does, indeed, exist.

Manufacturers of products — hardware, software and firmware — are encouraged by us to submit their products to THE RAINBOW for certification. We ascertain that their products are, in actuality, what they purport to be and, upon such determination, award a Seal. This lets you know that we have seen the product and that it does, indeed, exist.

The Seal, however, is not a "guarantee of satisfaction." The certification process is different from the review process. You are encouraged to read our reviews to determine whether the product is right for your needs.

There is absolutely no relationship between advertising in THE RAINBOW and the certification process. Certification is open and available to any product pertaining to CoCo. A Seal will be awarded to *any* commercial product, regardless of whether the firm advertises or not.

We will appreciate knowing of instances of violation of Seal use.

16K
ECB

Chopin's Minute Waltz

By Eugene Vasconi

Who needs the stereo when you've got the CoCo? Here is a music program that brings a classical composer up to date. Frederic Chopin was born in 1810, composed mainly piano dance music, and certainly never figured he'd make the CoCo top 10, but we think he'd be pleased.

This is the *Minute Waltz* (it really takes about a minute and a half) and is a good example of how to make one sound generator seem like four. The transcription is, with a few computer-necessary adjustments, a faithful transcription of how Chopin intended it — even to the dynamics.

The program uses the `PLAY` command and, by manipulating note lengths and voicing, gives the impression of harmony. A group of biographical pages sets the stage for Hi-Res graphics and the performance, which concludes in grand concert style. The final option is to have an encore or end.

Minute Waltz, requiring 16K ECB, is part of a 10-program series developed for educational or home entertainment

---

(Eugene Vasconi is a free-lance television producer in the Dallas area. Interested in the music and graphics aspects of the Color Computer, he received his undergraduate degree in music and holds a master's in telecommunications.)

PRICKLY-PEAR SOFTWARE

QUALITY PROGRAMS FOR YOUR COCO & TDP-100

PROGRAMS REQUIRE 16K EXTENDED BASIC FOR TAPE, AND 32K DISK UNLESS OTHERWISE NOTED.

MICROARTIST NEW

Finally!!! a graphics program so easy to use anyone can create beautiful detailed pictures. Save your pictures to tape or disk and incorporate your artwork in your own programs or print it out on your graphics printer. **MICROARTIST** accomodates Gemini, Epson and Radio Shack DMP printers.

The easy menu selection provides **16** modes of operation. Besides the basic GEOMETRIC MODES you can ERASE all or part of the screen. ZOOM in on any portion of your picture and the enlarged screen allows you to edit your picture one pixel at a time. GET/PUT allows you to move one area of your picture to another part of the screen. SAVE and LOAD your pictures to tape or disk. Choose from **100** solid or stripe combination colors to PAINT your pictures. Add texture to your picture with SPRAY PAINT. Use the TEXT mode to sign or label your art work.

And that's not all! We've even included two utilities to make **MICROARTIST** even more fun. The first will display all 100 color combinations on the screen. Choose the ones you like best for your palette. The second utility will copy a picture in basic or assembly language into the **MICROARTIST** format. You can then edit and expand the picture to fit your own needs.

Take advantage of all the COLOR your COLOR computer has to offer. Order **MICROARTIST** now. Requires 32K Extended Basic and a mouse or joystick. **Tape - $24.95; Disk - $29.95**

SCEPTER OF URSEA NEW

Explore the kingdom of Ursea in search of the elusive sceptor. The country-side is represented by an elaborate graphics screen which harbors friend and foe alike. Or enter the dark dungeon, where unknown dangers and wealth await you. Roll up your character and set out on a great adventure.

SCEPTOR OF URSEA is a one player adventure game based in a fantasy world of feudal kings and lords. To become king of Ursea you must find the lost sceptor and return it to Ursea. The extensive documentation will give you all the information you need to know to travel through Ursea. It is up to you, however, to use this information wisely. Are **YOU** wise enough to become King?

This adventure is unique in that you may travel through the countryside represented in a graphics screen or enter the dungeon and travel through its three levels. You may leave the dungeon to return to the outside at any time. And, of course, you can save the game in progress. Req. 32K EB. **Disk only $29.95**

CITY WAR NEW

Strategy and politics are the key to winning **CITY WAR.** This challenging simulation game requires both. The two great nuclear powers battle for world supremacy. The object is to eliminate the leader of the opposing country. The two leaders are hidden in one of eight major cities of their respective country. Fire your missiles at your chosen target or protect your city by firing an anti-ballistic missile.

This battle of the two great nuclear powers is a two-player game. But, better yet, form two teams and make **CITY WAR** even more realistic by putting your strategic and political decisions to a vote.

There are 14 commands accessed by a single key stroke. With your secret access code you are the only one that can command your army of missiles. You can even request a cease fire from your opponent. The "save the game" feature makes it easy to resume negotiations. Requires 16K. Tape - **$24.95;** Disk - **$29.95**

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Line	Description
1-2	Title page
3-11	Draw three-dimensional letters
12	Biographical information
13-39	Draw small letters
40-49	Create piano keyboard
50-55	Create border
56-64	Additional biographical information
65-78	Paint/repaint loop for 3-D letters Wait for perform input
79-118	Play commands for the waltz
119-127	Close curtain sequence
128-135	Print replay or end screen and wait for input

(Any questions regarding this program may be directed to Mr. Vasconi at 1907 Moser, Apt. 207, Dallas, TX 75206, phone (214) 826-6244.)

12	93
40	164
57	115
65	239
87	41
95	166
104	69
113	167
END	210

The listing: `MNUTWALZ`

```
1 CLS(3):PRINT@109,"waltz";:PRIN
T@174,"BY ";:PRINT@199,"FREDERIC
 CHOPIN ";
2 PRINT@391,"TRANSCRIBED BY ";:P
RINT@423,"EUGENE VASCONI ";
3 PMODE3,1
4 PCLS(2)
5 COLOR5,3
6 DRAW"BM24,12;D40F20R32NU12H20N
L32U40NF12L8D32L4U8NF4L8D8L4U32N
F16L8"
7 DRAW"BM68,20;D32F20R8NU8H20NL8
U8NF20R16D8NR8F12NL8F8R8NU12H20U
32NF12H8L16G8;BM76,36;R12NH12R4U
12H4L8G4D12"
8 DRAW"BM112,12;D40NR32F20R32NU8
H20U8NF20L4NU12L20U32NF20L8"
9 DRAW"BM148,12;D8NF12R12D32NR8F
20R8NU32H20U32NF20R12NF16U8NF20L
32"
10 DRAW"BM192,12;D8NF11R20G20NL4
D12NR32F20R32NU8H20U8NF20L20U4NF
4E20F20NG12U8H20ND8L32"
11 PAINT(16,16),3,5
12 CLS(6):PRINT@98,"FREDERIC CHO
PIN WAS BORN IN      ZELAZOWA WOL
```

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```
A NEAR WARSAW,          POLAND IN 18
10. THE SON OF A        FRENCH TEACH
ER, HE TAUGHT           HIMSELF PIAN
O AND LATER WENT        ON TO STUDY
AT THE WARSAW           CONSERVATORY
. ";
13 DRAW"BM84,80;G4D8F4"
14 DRAW"BM88,92;U8R4ND4R4D8"
15 DRAW"BM104,92;U8"
16 DRAW"BM112,92;U8F8U8"
17 DRAW"BM128,84;D8R8U8"
18 DRAW"BM144,84;R4ND8R4"
19 DRAW"BM168,92;L8U4NR4U4R8"
20 DRAW"BM172,80;F4D8G4"
21 EE$="NR8U8NR4U8R8"
22 RR$="U16R8D8L4NL4F4D4"
23 CC$="NR8U16R8"
24 DRAW"BM24,178;U8NR4U8R8"
25 DRAW"BM40,178;XRR$;"
26 DRAW"BM56,178;XEE$;"
27 DRAW"BM72,178;U16R4F4D8G4L4"
28 DRAW"BM88,178;XEE$;"
29 DRAW"BM104,178;XRR$;"
30 DRAW"BM120,178;U16"
31 DRAW"BM128,178;XCC$;"
32 DRAW"BM152,178;XCC$;"
33 DRAW"BM168,178;U8NU8R8NU8D8"
34 DRAW"BM184,178;U16R8D16L8"
35 DRAW"BM200,178;U16R8D8L8"
36 DRAW"BM216,178;U16"
37 DRAW"BM224,178;U16F4D8F4U16"
38 COLOR5,5
39 LINE(24,104)-(228,148),PSET,B
F
40 COLOR 3,5
41 FORX=36TO216STEP12
42 LINE(X,104)-(X,148),PSET
43 NEXTX
44 COLOR 2,2
45 FORX=32TO200 STEP82
46 LINE(X,104)-(X+8,132),PSET,BF
:LINE(X+12,104)-(X+20,132),PSET,
BF
47 NEXTX
48 FORX=68TO152STEP82
49 LINE(X,104)-(X+8,132),PSET,BF
:LINE(X+12,104)-(X+20,132),PSET,
BF:LINE(X+24,104)-(X+32,132),PSE
T,BF
50 NEXTX
51 FORX=4TO252STEP4
52 COLOR 4,3
53 CIRCLE(X,0),4:CIRCLE(X,198),4
:NEXT
54 FORX=4TO198STEP6
55 CIRCLE(2,X),4:CIRCLE(254,X),4
```

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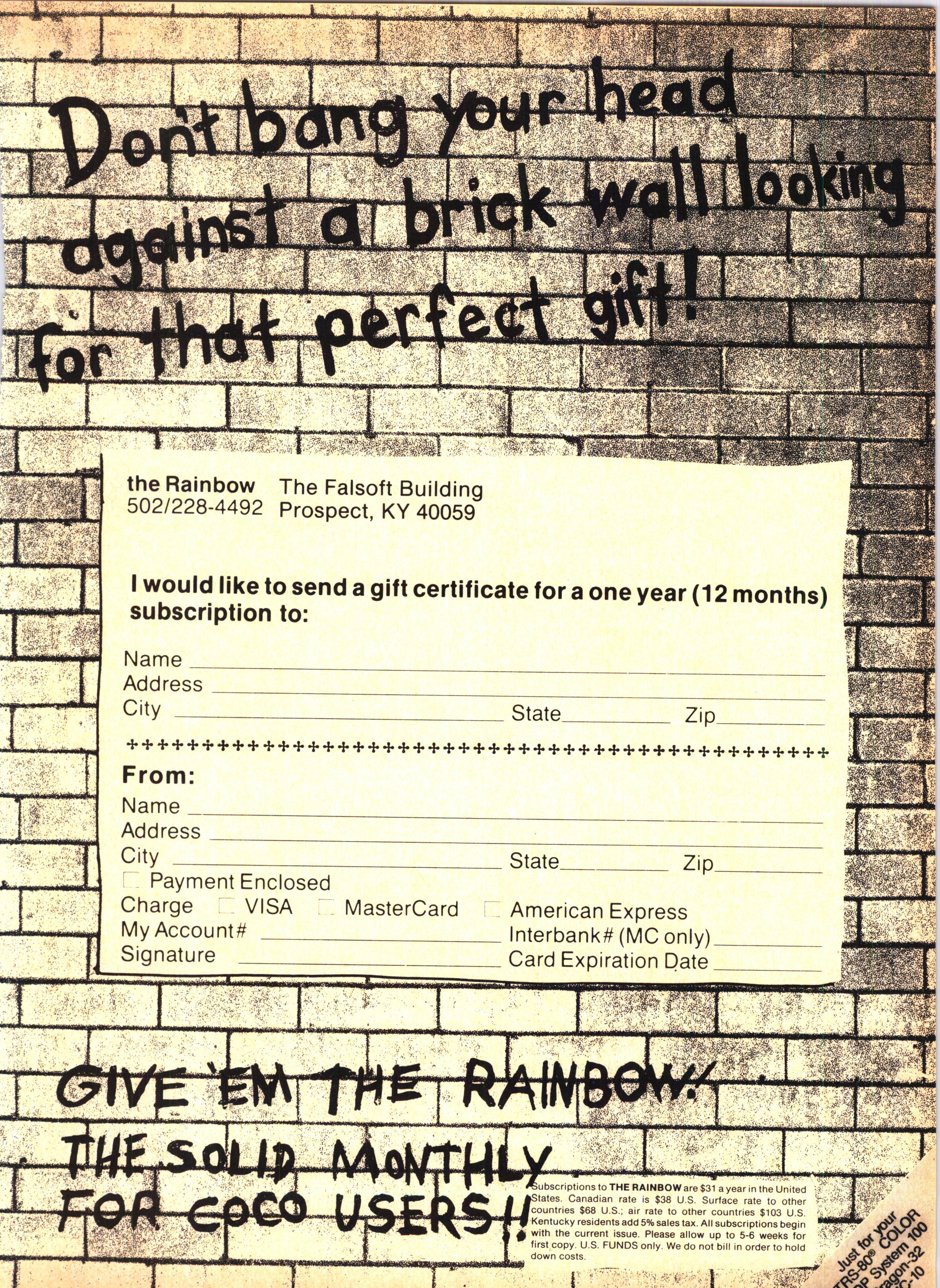
```
:NEXT
56 CLS(4):PRINT@98,"AFTER TOURIN
G GERMANY AND       ITALY, HE MO
VED TO PARIS AS A   PIANO TEACHE
R. ONCE THERE HE    MET AND LIVE
D WITH WRITER       AURORE DUDEV
ANT (PEN NAME       GEORGE SAND)
. ";:FORX=1TO6000:NEXTX
57 CLS(7):PRINT@98,"THE TEMPERME
NTAL CHOPIN ALWAYS  PREFERRED SM
ALL AUDIENCES TO    LARGER CONCE
RTS AND A HANDFUL   OF ONLY 74 M
AJOR LISTINGS       REFLECT THAT
 DESIRE. THEY       INCLUDE SCHE
RZOS, BALLADES,    ";
58 PRINT@288,"  NOCTURNES, MAZUR
KAS, ETUDES,    PRELUDES, AND WA
LTZES. ":FORX=1TO7000:NEXTX
59 CLS(5):PRINT@98,"IT IS AMAZIN
G THAT, IN THE      SHADOW OF BE
ETHOVEN, CHOPIN     COULD HAVE M
ADE SUCH A NAME     BY WRITING M
AINLY PIANO DANCE   MUSIC. THAT
HE DID IS A         TRIBUTE TO H
IS TALENT WHICH     STILL TAXES
MANY PIANISTS. ";
60 FORX=1TO6000:NEXTX
61 CLS(6):PRINT@98,"THE MINUTE W
ALTZ IS ONE OF HIS  BEST KNOWN C
OMPOSITIONS; IT     SHOWS THE EX
CITING ACROBATICS   AND BROAD, F
LOWING MELODIES     HE COULD CRE
ATE. IT REALLY      DOESN'T TAKE
 A MINUTE - MORE    LIKE A MINUT
E AND A HALF! ";
62 FORX=1TO6500:NEXTX
63 CLS(0):PRINT@98,"CHOPIN ALWAY
S LONGED TO RETURN   HOME AND IT
 SHOWS IN HIS        MUSICAL THE
MES. HE DIED OF      TUBERCULOSI
S IN PARIS IN        1849. HE WA
S 39. ";:FORX=1TO5000:NEXTX
64 PRINT@421,"PRESS <P> TO PERFO
RM ";:FORX=1TO1000:NEXTX
65 PP=0
66 SCREEN1,1
67 R=RND(4)
68 PP$=INKEY$
69 IF PP$="P" THEN PP=1
70 IF PP=1 THEN R=4
71 IF R=1 THEN 67
72 PAINT(28,18),R,5
73 PAINT(72,24),R,5
74 PAINT(116,24),R,5
75 PAINT(164,24),R,5
76 PAINT(216,16),R,5
77 IF PP=1 THEN GOTO 79
78 GOTO67
79 A=0:B=0
80 A$="L32O3GO2D-P16L16O3A-P16L6
4O4CO2A-O3D-FP16L16B-P16L64GO2A-
O3D-FP16L16A-P16"
81 B$="L32O4CO2FP16L16O3B-P16L64
GO2A-O3D-FP16L16A-P16L64O4CO2A-O
3D-FP16L16B-P16"
82 C$="L32O3B-O2FP16L16O4CP16L64
D-O2A-O3D-FP16L16O4E-P16L64FO2A-
O3D-FP16L16O4G-P16"
83 D$="L32O1A-L8.O4B-P32L64O2A-O
3CG-P64P16L16O4A-P16L64G-O2A-O3C
G-P16L16O4FP16"
84 E$="L32O4FO2E-P16L16O4E-P16L6
4E-O2A-O3CG-L32O4FE-L16DP16L64E-
O2A-O3CG-P16P8"
85 F$="L32O4A-O3A-O1A-P32P8L64O2
G-A-O3CP64P16P8EO2G-A-O3CP16P8"
86 PLAY"V23T6;L4O3A-L8GA-O4CO3B-
GA-B-A-O4CO3B-GA-O4CO3B-GA-O4CO3
B-GA-O4CO3B-"
87 PLAY"T6XA$;V25;XB$;V27;XA$;V2
9;XC$;V31;XD$;V23;XE$;V29;XD$;"
88 PLAY"V24L32O4FO2A-P16L16O4E-L
32FE-L64DO3CG-P64P16L16O4E-P16L6
4FO3CG-P64P16L16O3B-P16;XA$;XB$;
XA$;V27;XC$;V31;XD$;V24;XE$;V20;
XD$;"
89 PLAY"L32O4E-O2A-P16L16O4FP16L
64E-V24O3CG-L32O4FE-L16DP16L32E-
O1A-P16L16O4EP16"
90 PLAY"V20L24O4FO1AL12O4G-FL64E
O2FO3CE-P16L16O4FP16L64A-O2FO3CE
-P16L16O4G-P16L32FO1B-P16L16O4G-
P16L64V22FO2FO3D-P64P16L16O4EP16
L64FO2FO3D-P64P16L16O4B-P16"
91 A=A+1:B=B+1
92 PLAY"V24L24O4A-O2CL12O4B-A-L6
4GO2A-O3E-G-P16L16O4A-P16L64O5CO
2A-O3E-G-P16L16O4B-P16 V27L32A-O
2D-P16L16O4B-P16L64A-O2A-O3FP64P
16L16O4GP16A-P16O5D-P16"
93 PLAY"V31L32O5CO2G-P16L16O4B-P
16L64A-O2B-O3E-P64P16L16O4G-P16F
P16E-P16 V25L32D-O1A-P16L16O4CP1
6L64O3B-O2FA-O3D-P16L16O3A-P16G-
P16FP16"
94 PLAY"V20L32O3E-O1A-P16L16O3D-
P16L64CO2G-A-P64P16L16O3E-P16L64
B-O2G-A-O3CP16L16A-P16 V22L32GO2
D-P16L16O3A-P16L64B-O2A-O3D-FP16
V28L16O4CP16D-P16E-P16"
95 PLAY"L24O4FO2AL12O4G-FV30L64E
O3E-FP64P16L16O4FP16L64A-O3E-FP6
4P16L16O4G-P16 L32FO2B-P16L16O4G
-P16L64FO3D-FP64P16L16O4EP16L64F
O3D-FP64P16L16O4B-P16"
96 PLAY"L24O4A-O3CL12O4B-A-L64GO
3G-A-P64P16L16O4A-P16L64O5CO3G-F
P64P16L16O4B-P16 L32A-O3D-P16L16
```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```
O4B-P16L64A-O3FA-P64P16L16O4GP16
A-P16O5FP16"
97 IF B=4 THEN GOTO117
98 PLAY"L32O5E-O2G-P16L16O5D-P16
L64CO3D-E-B-P16L16O4B-P16A-P16G-
P16 V27L32FO1A-P16L16O4E-P16L64D
-O2FA-D-P16L16O4CP16O3B-P16A-P16
"
99 PLAY"V23L32O3AO1A-P16L16O4CP1
6L64B-O2G-A-P64P16L16O3FP16L64G-
O2G-A-P64P16L16O3CP16 V20L32D-O2
D-P16P8O3FO2A-P16P8"
100 IF A=2 THEN GOTO 103
101 PLAY"L5O4F"
102 IF A=1 THEN GOTO 90
103 PLAY"V21L4O3A-L32A-O1A-P16P8
L64O2G-A-O3CP64P16P8O3E-O2G-A-O3
CP16P8 A-O2G-A-O3CP16P8O2G-A-O3C
P64P16P8EO2G-A-O3CP16P8 V24L32A-
O2D-P16P8A-O3D-P16P8L64FO2A-O3D-
P64P16P8"
104 PLAY"V28L32O4FO1A-P16P8L64O2
A-O3D-FP64P16P8O4FO2A-O3D-FP16P8
 L16O2E-P16P8L64O2A-O3CG-P64P16P
8B-O2A-O3CG-P16P8 L32O4FO1A-P16P
8L64O2A-O3E-G-P64P16P8O4CO2A-O3E
-G-P16P8"
105 PLAY"L32O4E-O2D-P16P8L64O2A-
O3D-FP64P16P8O4D-O2A-O3D-FP16P8
L32O4CO2FP8L16O4E-P64L64O2A-O3D-
FP64P16L16O4D-P16L64O2A-O3D-FL16
B-P32P8 L32A-O1CP16P8O2G-A-P16P8
L64O3E-O2G-A-P64P16P8"
106 PLAY"V20L32O3A-O1A-P16P8L64O
2G-A-O3CP64P16P8EO2G-A-O3CP16P8V
24L32A-O2D-P16P8O2A-O3D-P16P8L64
FO2A-O3D-P64P16P8 V28L32O4FO1BP1
6P8L64O2A-O3D-FP64P16P8O2A-O3D-F
P64P16P8"
107 PLAY"L32O4CO2CO4DCO3BO4CP16L
64O3BO2A-O3CFP16P8O4CO2A-O3CFP16
P8 L32O4A-O1CP16P8L64O3B-O2GO3CE
P16P8 L8O4GP8L32O3AO1FP16P8L8V24
O4G-P8L64O3A-O2FO3CP64P16P8"
108 PLAY"L8V20O4FP8O3FP8B-P8"
109 PLAY"V22L32O3A-O2CP16P8G-A-P
16P8L64O3E-O2G-A-P64P16P8 ;XF$;L
32O4A-O3A-O2D-P32P8A-O3D-P16P8L6
4FO2A-O3D-P64P16P8"
110 PLAY"L32O4A-FO1A-P32P8L64O2A
-O3D-FP64P16P8O4FO2A-O3D-FP16P8
L32O4A-FO2E-P32P8L64O2A-O3CE-P64
P16P8B-O2A-O3CG-P16P8 L32O4A-FO1
A-P32P8L64O2A-O3E-G-P64P16P8O4CO
2A-O3E-G-P16P8"
111 PLAY"L32O4A-E-O2D-P32P8L64O4
D-O2A-O3D-FP16P8O4CO2A-O3D-FP16P
8 L32O4A-E-O2FP32P8L64O4D-O2A-O3
D-FP16P8O2A-O3D-FP64P16L8B- L32O
4A-O3A-O2CP32P8G-A-P16P8L64O3E-O
2G-A-P64P16P8;XF$;"
112 PLAY"L32O4A-O3A-O1BP32P8L64O
2FA-O3E-P64P16P8FO2FA-O3E-P16P8
L32O4FO1B-P16P8L64O2FA-O3DP64P16
P8O2FA-O3DP64P16P8 L32O4FO2E-P16
P8O3D-GP16P8L64B-D-GP64P16P8 L4O
4E-L32O3D-G-P16P8L64AD-G-P64P16P
8"
113 PLAY"L64O2A-L8O4E-T5P64P32P1
6L64O3CG-L8A-P32P16T3V24L8O4DP8
T2L4FE-T1L2V29O4A-P8"
114 PLAY"V18"
115 FORX=1TO4:PLAY"V+T6O3L8A-B-A
-B-A-B-":NEXTX
116 PLAY"V22L8O3GA-O4CO3B-GA-O4C
V26O3B-GA-O4CO3B-GA-O4CO3B-GA-V2
8O4CO3B-GA-O4CO3B-":A=0:GOTO87
117 PLAY"V30T5L24O5E-O1G-L12O5D-
CO4B-L64O3D-E-B-L12V26O5A-G-FE-D
-CO4B-A-G-FE-V22T4D-CO3B-T3L64AO
1AP32P8L16O4CP8L64O3B-O2G-A-P64P
16T2L8V25O3FL64O2G-A-L8.O3G-L4V2
8CL32T2V30O1V28D-L2O3D-"
118 FORX=1TO15:PLAY"L125O2FA-O3F
":NEXTX
119 FORX=1TO900:NEXTX
120 COLOR5,5
121 FORX=4TO184
122 LINE(6,X)-(250,X),PSET
123 PLAY"L250O5B-B"
124 NEXTX
125 PLAY"L255V31O1CC#CC#CC#CC#"
126 FORX=1TO400:NEXTX
127 PLAY"L180O1D-FA-O2D-FA-O3D-F
A-O4D-FA-O5D-FA-"
128 SCREEN0,0
129 CLS(0):FORX=1TO600:NEXTX
130 PRINT@133,"FOR ENCORE PRESS
<P> ";:PRINT@391,"TO END PRESS <
Q> ";
131 PP$=INKEY$
132 IF PP$="P" THEN GOTO 1
133 IF PP$="Q" THEN GOTO 135
134 GOTO 131
135 CLS:PRINT@0,"BYE !":SOUND1,1
:END
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The One Great Secret To Assembly Language

By R. Bartly Betts
Rainbow Contributing Editor
With Programs By Chris Bone

Last month I said I would use this column to provide answers to your questions and cut down on my correspondence load. It isn't working; I am only getting more letters! I appreciate hearing from you, but . . . ah well, there are penalties for being famous (or infamous).

In any case, if you don't hear from me soon after you write, it may be I have a pile of letters to answer before I come to yours, or it may be that I will try to answer your letter in the column, or it may be you didn't provide a self-addressed, stamped envelope. I haven't refused to answer a letter lacking return postage yet, but I may have to begin — four or five dollars a week can add up.

Following are the answers to this month's questions and comments:

1) Although no one has actually asked, "What is the one great secret of assembly language?", Chris said he feels many readers are searching for the answer to such a question. I agree with him, and so present the following great secret:

(R. Bartly Betts is currently a technical writer for Tandy Corp. and is a former news reporter and magazine editor. As the father of 10 children, computers are his escape from reality.

Chris Bone is a college computer science major and has been programming for more than three years. He averages between six and nine hours a day on the CoCo.)

> There is no secret to assembly language. Proficiency comes through hard work. If you apply yourself for several hours a day, you can probably be an adequate programmer in a year's time. In three to five years you can probably be a good programmer and begin to compete with some of the better software authors.
>
> This column will not make you into a good programmer, no matter how long it continues. Its purpose is to get you started and over the rough spots.
>
> Now that I have said that, let me encourage you a bit. It does not take a year to become familiar with assembly language; a few weeks will do. It does not take a year to learn to enter programs another person wrote; a few days will do.
>
> But assembly language programming is a profession and, if you want to do it well, you must work at it in the same manner as any other profession.

2) I have received a letter from Shawn Jack. If you remember, he was one of the programmers who sent in an answer to the initial "Byte Master" challenge of changing 'A's to asterisks. It seems I misread his address; he lives in Goreville, Illinois, not Ooreville.

3) I have received several requests for back copies of my articles. I am afraid it is a request I cannot fill. The first time I was asked, my reaction was, "why not?" Then I realized that doing so is probably illegal. While I have copies of my articles, they have been sold to THE RAINBOW and I have no more right to copy and distribute them than anyone else.

I also do not have time. It would probably take a couple of hours to make copies of all my articles. If 10 people asked me for copies, that is 20 hours. My wife and family can think of lots of other things for me to do with 20 hours.

4) I also received a request for an "editor/assembler." This is a software product that is sold by Radio Shack and other companies. There are several editor/assembler packages on the market, but I am afraid I know of none that are available as "public domain" packages (programs available to anyone free of charge).

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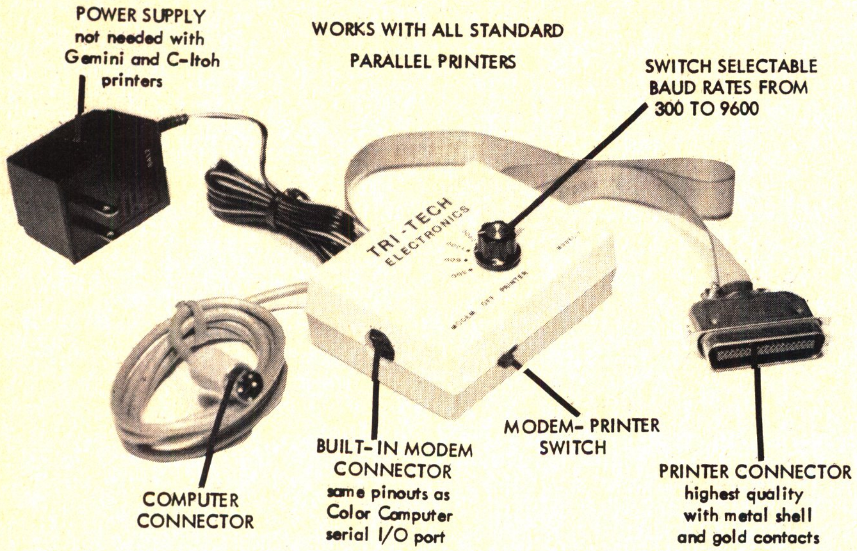
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TRI-TECH ELECTRONICS

P.O. BOX 8100 ROCHESTER, MICH. 48308 (313) 254-4242 assembler and do not have the money to buy one, the best I can offer is the BASIC program from last month's article, and/or a monitor program from past issues of THE RAINBOW. I gave some pointers for using these methods in the last column.

5) As far as I know, the 51-column *Bytescreen* program will work with any Color Computer configuration. I have heard from readers who have used it on nearly all versions of computers, ROMs and accessories. If you have problems, let us know and we will either fix them or at least warn others.

6) Chris and I are extremely interested in any upgrades you make to the *Bytescreen* program. Chris is working on several upgrades to the program. If you have made, or do make improvements you would like to share with other readers, please submit them. We have already received one upgrade that, if the author is willing, will be included in the next column. I think it would be great to continue this until we develop a super program.

7) There do seem to be problems with the *Find* program introduced by this column. It doesn't seem to work on all BASIC programs. If Chris or I ever get time, we will try to fix it. It seems to crash only after it has done its job, so perhaps it still helps.

Assembly Help

Last month's column mainly dealt with how to translate source code listings into machine language. Because of the trouble many readers seem to be having, I have decided to give equal time to those of you with editor/assemblers. I will try to not repeat what has already been said in previous columns, but expand on it to help those who are still having trouble.

The difficulties seem to be in the area of assembling, after listings have been typed, and knowing where to put in-memory assemblies. The information in this column will deal with the *EDTASM+* program. This is for two reasons: *EDTASM+* is what I use and, judging from the questions and letters I receive, it is what you are using. So far, I have not heard from anyone using another assembler.

Those Bad 'Bad' Errors

As you know from reading your manual, the cartridge version of *EDTASM+* resides between memory location $C000 and $DFFF. If you have a 16K computer, you have RAM memory from $600 to $3FFF for your program storage. If you have a 32K computer, you have RAM memory from $600 to $7FFF for storage.

However, in order to keep track of variables and labels, *EDTASM+* must use some of that memory. First, it reserves $200 bytes for variables buffers and stacks at the bottom of the available memory. Second, as you write programs, the edit buffer grows from the bottom of the memory upward. Third, storage space is allocated for all symbols in your program and their corresponding values.

As you can see, writing programs causes allocated memory to expand upward, decreasing the room you have available for in-memory assemblies. Depending on the RAM size of your computer, you can enter programs which use so much of that RAM, there is not sufficient room to assemble the program in memory. When this happens, you get the familiar "bad memory" error message. I have had

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numerous complaints about this problem.

How can you tell if you have enough room to assemble a program in memory? Well, the easiest way is to try assembling it without an `ORG` line. This causes *EDTASM+* to begin assembling the program at the first available memory location. If you get a "bad memory" error with this procedure, there simply is not room.

When there is not room, or you must assemble a program in an area that is already used by *EDTASM+*, an alternative is to assemble the program to tape or disk. Exit *EDTASM+* and load the program using `CLOADM` and `EXEC`. However, be sure you save the source listing before doing this, then if it doesn't work the first time, you will not have to type the listing again.

It's Worse with Disk

If you have the disk version of *EDTASM+*, everything operates in the same manner as previously described except *EDTASM+* is not resident between $C000 and $DFFF. In fact, it is resident in your RAM and this poses a special problem. You now have much less free RAM for buffers and storage. You are even more likely to get the "bad memory" error. You are sacrificing a great deal of memory for the advantage of disk speed.

There is little you can do to overcome the "bad memory" error other than what I have suggested. If you have a 16K computer, you can upgrade to 32K. You can also hope someone will write a 64K editor/assembler for those of us who have fully upgraded machines.

If you must assemble programs in *EDTASM+*'s buffer and stack area, *EDTASM+* provides a "MO" (manual origin) switch you can use to change the location of the buffer and the normal beginning of in-memory assemblies. This switch is described in the *EDTASM+* manual with step-by-step instructions.

While this process lets you change the automatic `ORG` location, it does not add more room for assemblies. If you were out of room before, you will be out of room after implementing MO.

The Assembly

The other most common problem seems to be with the assembly process itself. For that reason I have written a simple program (Listing 1), and will go through the entire typing, checking, saving and executing process.

If you are familiar with all of this, have patience with those who are not. After hearing the trouble others were having, I went through the books I have and found there is no one place that explains the process. I also remember having similar problems when I first began.

Listing 1: `BYTE 1`

```
00090            ORG      $E00   *PROGRAM ASSEMBLY LOCATION
00100  START     LDX      #$400  *BEGINNING OF TEXT SCREEN MEMORY
00110 LOOP       LDD      ,X     *LOAD D WITH VALUE AT X
00120            EORA     #64    *EXCLUSIVE OR A
00130            EORA     #64    *EXCLUSIVE OR B
00140            STD      ,X++    *STORE D INTO LOCATION AT X
00150            CMPX     #$600   *CHECK FOR END OF TEXT SCREEN
00160            BNE      LOOP    *IF NOT END, DO AGAIN
00170            RTS              *END PROGRAM
00180            END
```

The purpose of this program is to reverse everything on the text screen. It does this by loading Register X with the beginning location of the text screen. The value pointed to by 'X' is then loaded into Register D (registers A and B). An exclusive `OR` operation is performed on registers A and B, then Register D is stored back into the screen location pointed to by 'X.' Register X is incremented, and this process is continued until the end of the screen is reached at $5FF.

To type in the program, load *EDTASM+*; either plug in your ROM pack or load the program from diskette. When *EDTASM+* is operating, press `I90` ENTER. The first line number 90 appears on the left of the screen. Because there is no label in the first column of this line, press the right-arrow key to skip one column to the right. Now type `ORG` and press the right arrow again and type `$E00` ENTER.

Notice that you do not need to type the comments (text that follows an asterisk). The comments are for your instruction only and have nothing to do with the operation of the assembler.

When you press ENTER, the cursor drops to the next screen line. Now type the label name `START` and press the right arrow. Type each column text and data as you did for Line 1.

After all of the lines are typed in, you are ready to assemble the program. However, it is a good idea to first make sure that if something goes wrong, you do not have to type in the program again. To do this, save the listing you have typed to disk or tape.

To save it to tape, type `W` and ENTER. A prompt asks you for the filename; type `REVER` and ENTER. You are prompted to ready the tape recorder. Insert a tape, position it where you want, press the Play and Record keys, then press ENTER.

To save the listing on disk, type `W REVER` and ENTER. You have now saved the source code and can safely attempt other processes without fear of losing what you have typed.

Program Checking

You may wish to check the program before you assemble the listing to tape or disk. You can do this by assembling it in memory. The `ORG` line of the listing directs the assembly to $E00. To assemble the program in memory, type `A/IM/WE`. The 'A' is the command to assemble a listing, "IM" is a switch telling the assembler to assemble the listing in memory, and "WE" is a switch telling the assembler to stop if it encounters an error.

Assembly in memory tells you if there are any errors in the program that are incompatible with *EDTASM+*; it puts the program where it is meant to reside and from where you can give it a trial run. If any errors are encountered, the program stops after printing the offending line.

It also tells you what the error is so you can correct it. To correct a line, type `E` followed immediately by the line number, for instance `E120` (you do not need to include the preceding zeros in a line number). You can then space through the line with the space bar and use the normal Extended BASIC editing commands to fix the error and attempt another assembly.

When the listing is correct, the assembler lists the entire assembly to the screen, ending with a display indicating zero errors and the names of the labels used in the listing.

Zooming in ZBUG

You can now do further checks on

your program by using your editor/assembler's ZBUG features. To enter ZBUG, type Z and ENTER.

One way to try out the program is to type GSTART and ENTER. The 'G' is a command telling ZBUG to execute a program. "START" is the label indicating the beginning line of your program and where to begin execution. If all works, the screen will be reversed in a twinkling of an eye.

If the program crashes or doesn't work properly, you can sometimes recover it by pressing BREAK or the Reset button. If neither of these actions bring *EDTASM+* back, you will have to shut the computer off and reload *EDTASM+*, then reload the listing you have saved.

You reenter the edit mode from ZBUG by typing E and ENTER. If you had a total crash, reload *EDTASM+* and then reload your listing by typing L ENTER REVER ENTER for the tape version, or L "REVER ENTER for the disk version. You must now find the mistake and correct it before attemping execution again.

If you are having problems, you can also try your program from ZBUG by single stepping. To begin single stepping, type START, (that's START followed by a comma). You execute each subsequent line by pressing the comma. Each line of the program is displayed on the screen before it is executed and, when a crash occurs, you can see exactly where it happens. You can enter other commands (such as R) to examine the registers between steps.

Note that START is used to point to the beginning of the assembled program. Other listings may have another label to indicate their beginning or no label at all. If there is no beginning label, you must use the beginning address of the program, such as GE00.

Making Progress

I realize there are also many of you who would like more "meat" in these columns. I promise to delve deeper in future columns. For now, I am trying to cover the bases for the beginners who are confused. Soon I hope we can all move forward together.

For those of you who do not have an editor/assembler, I am including the following listing of the previous program with the machine language code. I didn't include it earlier because I didn't wish to confuse anyone. Last month I explained how to enter machine language code. If you have forgotten, refer to last month's column.

Listing 2: BYTE 2

```
0E00            00090            ORG     $E00     *PROGRAM ASSEMBLY LOCATION
0E00 8E   0400  00100 START      LDX     #$400    *BEGINNING OF TEXT SCREEN MEMORY
0E03 EC   84    00110 LOOP       LDD     ,X       *LOAD D WITH VALUE AT X
0E05 88   40    00120            EORA    #64      *EXCLUSIVE OR A
0E07 88   40    00130            EORA    #64      *EXCLUSIVE OR B
0E09 ED   81    00140            STD     ,X++      *STORE D INTO LOCATION AT X
0E0B 8C   0600  00150            CMPX    #$600     *CHECK FOR END OF TEXT SCREEN
0E0E 26   F3    00160            BNE     LOOP      *IF NOT END, DO AGAIN
0E10 39         00170            RTS               *END PROGRAM
          0000  00180            END
00000 TOTAL ERRORS
```

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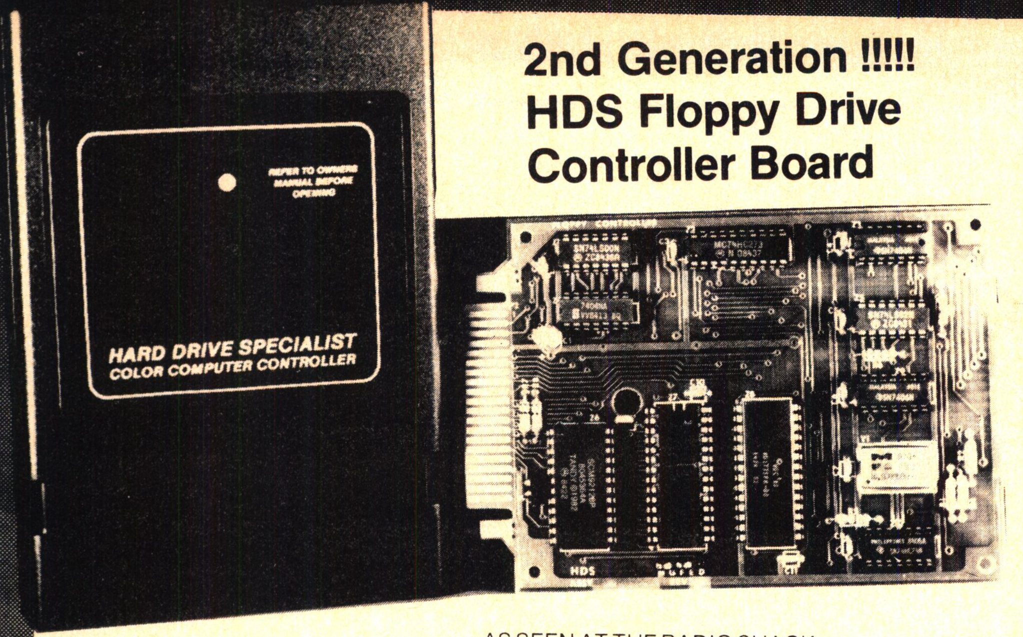
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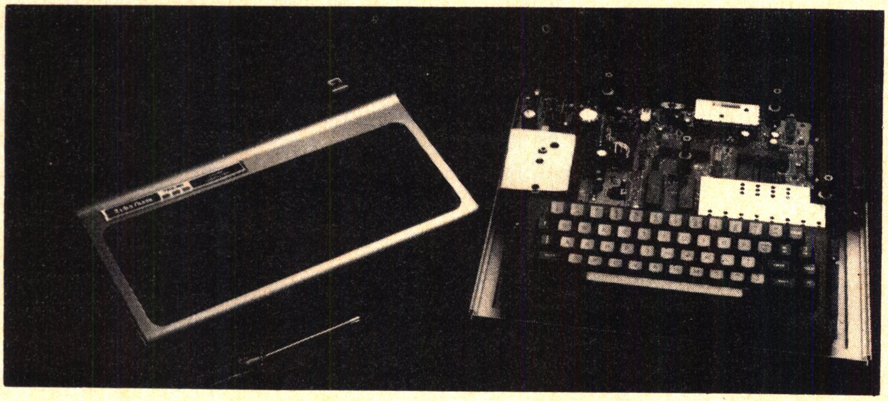

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How To Follow A Memory Map

By Tony DiStefano
Rainbow Contributing Editor

I feel like a broken record, but I still get a lot of questions and calls about memory mapping. Don't feel bad — it took me quite a while to get it right myself.

Let's go over it step by step. This time, I'll go into some hardware on how to memory map something to the CoCo *SCS area, which is the area mapped at 65344 ($FF40) to 65375 ($FF5F). This memory mapping technique will work on any version of the CoCo or CoCo 2 since the theory is the same. In fact, most of this theory will work on just about any computer.

A basic understanding of a CPU is a must when trying to understand mapping. By now everyone understands the importance of binary and Hex numbers; it has everything to do with mapping.

Let's start with binary: zero and one. That's it. A binary digit has only two values, zero and one. Two binary digits have four combinations: 00, 01, 10, 11. Three digits have eight and so on. Table 1 shows a four-bit number and the relation between decimal numbers, Hex numbers and binary.

Table 1

Decimal	Hex	Binary
0	0	1111
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

As you can see, a number from zero to 15 in decimal can be represented by one character from '0' to 'F' which is four binary bits. This is called a nibble. Now, a number from zero to 255 in decimal can be represented in Hex from '0' to "FF". This is called a byte. In binary, a byte takes up eight bits or two nibbles. The 6809 CPU (the CPU in the CoCo) has a data bus of eight bits, better known as an eight-bit CPU. (The internal structure is 16-bit, but I'll get into that story another day.)

Back to our nibble. This nibble represents 16 different combinations or discrete locations. Each different location becomes one memory location and each memory location has its own discrete address.

Address 0 (0000 in binary) is the first memory location (zero is a valid number). Address 1 (0001 in binary) is the second. But, that is only four bits; the 6809 has 16 bits used for memory locations which is a 16-bit address bus. Sixteen address lines means the CPU can access 65536 different locations. The first location is "0000000000000000" and the last location is "11111111 11111111," with 65534 combinations in between. For example, "10101000 01101010" is a valid location.

Writing out 16 zeros and ones every time we want to mention an address is silly. If we go back to our nibble, it can be represented by a single character. Sixteen bits would be four nibbles. Each nibble represents one-

(Tony DiStefano is well-known as an early specialist in computer hardware projects. He lives in Laval Ouest, Quebec.)

fourth of the 16-bit address. So, going back to our first location, we can now write it as a four-digit number, $0000.

The '$' in front of the number means the number to follow is in Hex; it can also be represented by the letter 'h' at the end of the number. The last location would now be $FFFF, and a number somewhere in between would be $CD8A.

That is the basic memory map of a CPU. Let's go back to our nibble for now — it is a little easier to work with. If we were to spread out each of the 16 locations into individual outputs, there would be 16 of them.

Most computer peripheral devices such as PIAs and VDGs require that a logical zero be used to select that particular device. That means if you have several devices connected to the same computer and want to select one at a time, all the select lines would be at logical one, except the peripheral that is to be selected. If we were to map out our four-bit address to one of 16, the result would look like the results in Table 2.

Table 2

Binary Number	One of 16 Select Lines
0000	1111111111111110
0001	1111111111111101
0010	1111111111111011
0011	1111111111110111
0100	1111111111101111
0101	1111111111011111
0110	1111111110111111
0111	1111111101111111
1000	1111111011111111
1001	1111110111111111
1010	1111101111111111
1011	1111011111111111
1100	1110111111111111
1101	1101111111111111
1110	1011111111111111
1111	0111111111111111

In each of the 16 examples, only one of the 16 lines is low, therefore only one of the possible 16 devices is selected. This is known as decoding. Decoding means separating a binary input to its individual outputs.

That is only four bits. If we were to look at 16 bits (the amount of address lines the 6809 CPU has), the decoded output would be one of 65536. Listing a table of the outputs would require several hundred pages (I think I'll pass on that one).

You can see the amount of components that goes into a chip. The amount of individual outputs doubles with every addition of one bit. Table 3 shows the relation between the amount of binary bits to the amount of individual select lines possible.

Table 3

Number of Bits	Number of Select Lines
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
10	1024
11	2048
12	4096
13	8192
14	16384
15	32768
16	65536

Do the numbers in the right-hand column look a bit familiar? They should: 1K, 2K, 4K, 8K, 16K, 32K and 64K. These are the real values people talk about when they say "K's." When you say your computer has "16K," it really has 16384 bytes of memory; 16K is just a rounded off number for the real thing.

OK, we now understand how a CPU can access all those bytes of memory. "How come I can't see thousands of wires and chip selects in my computer?" would be the next question. Well, there *are* thousands of wires and chip selects in your computer, but most of them occur inside the major chips of the computer.

Take, for instance, the Color BASIC chip. It is 8K, or 8192 bytes long. This is a good place to start. If you look back to Table 3, it takes 13 address lines (lines A0 through A12) to make up 8K of memory. The chip used for Color BASIC has 13 address lines. They connect to the first 13 address lines of the computer. That leaves us with a balance of three lines.

A typical Chip Enable line on a memory chip activates the whole chip. When *CE is activated, it works in conjunction with the other 13 lines. It

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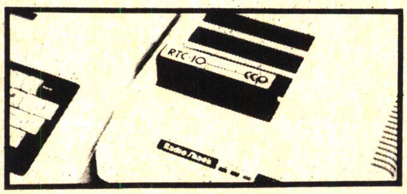

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is sort of a *master* select. The computer tells the chip that I want a byte of data. The other 13 lines tell the chip which of the 8192 bytes of data it wants.

Now, look back at Table 2. For the sake of theory, take the Color BASIC chip. Connect the first 13 lines (least significant) to the CPU. You are left with three unused lines (most significant). Look at the first three bits in Table 2. If you apply that theory to this situation, three bits can select eight devices.

Consider the Color BASIC chip as a device and connect one of the output lines of the three to eight decoders. A decoder such as this does exist; it has three inputs and has eight output lines. It also has other control lines, but we'll look into that a little later in this article. Connect the three binary input lines to the last three free address lines of the CPU. Depending on which output line we use, the CPU will select the Color BASIC chip on one of eight 8K borders.

If we put the chip on the first line, the CPU will activate the chip from memory location 0000 to 8191. If the chip was hooked up to the second, it then would see the chip as being from 8192 to 16383, the third would be from 16384 to 24576 and so on and so on, increasing by 8K every time, until we reach 64K. This is known as memory mapping. What we have done is memory mapped an 8K chip to the CPU. Again, where this 8K is depends on what output line of our decoder we use.

We have used all of the address lines in this situation. There are times when not all of the lines need to be used. When memory mapping a device to a CPU and not all the address lines are used, a condition called memory "ghosting" or "mirroring" is formed.

Memory mirroring is produced when the same chip is activated in two or more areas of memory. The best way to explain this is to use an example. Take the previous example of the 8K Color BASIC chip. The chip itself has 13 address lines connected to the CPU and the remaining three (most significant) lines of the CPU are decoded to one of eight. That leaves no address line free or unused. *If* we were to use a 4K chip instead of the 8K, there would be one less address line. Table 3 reveals that.

Now, leave this address line free and not connected to anything. When the CPU reads the first 4K of the chip (the only 4K in this case) all is fine, but when the CPU reads the next 4K, the 13th address line will change state. Since it is not connected to anything, the CPU will read the same thing as the first 4K. That is because the only address line that changed for the second 4K of memory is that free address line.

Let's take this one further and use a 2K chip. Now we have two free address lines. The CPU will see the same repeated data every 2K for the duration of the 8K bank. Bank is a word used to describe an area of memory. It is

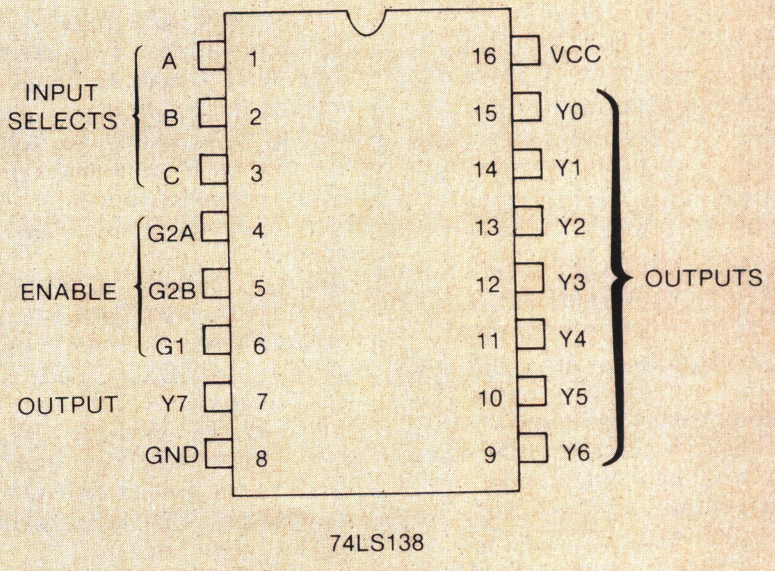

Figure 4A

INPUTS					OUTPUTS							
ENABLE		SELECT										
G1	G2*	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

*G2=G2A+G2B

H=LOGIC 1, L=LOGIC 0, X=IRREVELANT

Figure 4B

not any particular size, but referred to as an 8K bank or a 2K bank, whatever the size in question is.

It is not wrong to leave free lines when memory mapping, but it does make for inefficient use of memory. Take for instance the Disk Extended Color BASIC from Radio Shack. The chip itself is only 8K long, but is mirrored twice into 16K. It still works but renders the other 8K of memory unusable without more hardware to decode the free lines. This, however, does make for a less expensive parts count.

Now to get down to hardware. The area most frequently used by CoCo hardware hackers is *SCS: Spare Chip Select. It is already partially decoded by the SAM chip. It is sort of a mini "Master Select." The SAM chip decodes this area to be from 65344 ($FF40) to 65375 ($FF5F). It is only 32 bytes long, therefore also requires five address lines. These are A0 to A4. So the *SCS (Master Select), along with five address lines, makes up the 32 bytes of the memory map.

This area is great for I/O purposes such as the projects I presented in this column. Take, for example, my article "Lights! Camera! CoCo!" (December 1984, Page 24). It uses the *SCS pin. This is just the sort of thing I am talking about. I used just the *SCS pin and none of the other address lines. That means the chip I used is memory mirrored throughout the 32 bytes (five address lines) and is only one byte wide. I saved adding some chips, but in this case, I didn't need the rest of the area.

Now, if we take the three to eight decoder I mentioned earlier, and integrate it into the *SCS circuit, we could access more chips. Figure 4A shows the functions of a chip called the 74LS128. This is a computer compatible chip that works well with the CoCo. In fact, there is already one of these chips inside the CoCo. If you have a schematic for the CoCo, look it up.

Figure 4B shows the Truth Table for this chip. When you examine this table, you will notice the similarity between this and Table 1, only it is only three bits wide. There is a four to 16 decoder chip available, called a 74LS154, but you'll have to look that one up yourself.

Now, the diagram in Figure 5 shows how this chip can be hooked up to the CoCo and the *SCS pin. This is hooked up as such: You have eight separate chip enables from 65344 ($FF40) to 65351 ($FF47) and it is memory mirrored four times to make a total of 32 bytes. If we were to replace A0 with A1, A1 with A2, A3 with A4 and left A0 not connected, we would have every second byte memory mirrored. If we moved the address lines up one more, it would be every four bytes memory mirrored.

If we added more 74LS138s, we could even have 32 bytes not mirrored at all. It all depends on the decoding technique and how many free address lines we want.

I hope all this decoding has helped you understand more on how the CoCo works. See you next time, and we'll say hi to LEDS.

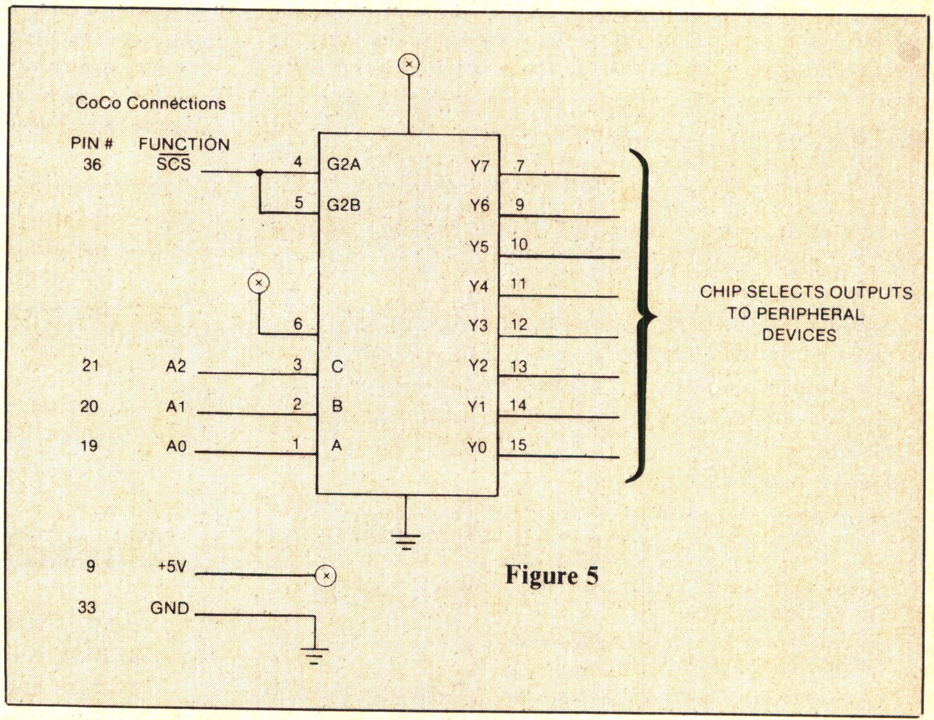

Figure 5

GAMEMASTER'S APPRENTICE

Role Playing Games Are Effective Learning Tools

By George Firedrake and Karl Albrecht

Lots of young people (and some not-so-young) are playing role playing games. Kids who "can't read" are reading, understanding and using rule books for role playing games — rule books that make a computer reference manual seem simple by comparison. Kids who "can't do math" are successfully dealing with numerical information, probability tables, economics of fantasyland and polyhedral dice in ways beyond the ken of most adults.

Role playing games might be the most powerful learning tools existing in our culture, more powerful by far than computers. Yet this incredible world of learning is virtually ignored by the educational establishment.

ROLE PLAYING GAMES

Millions of people play role playing games. A role playing game is a game in which one or more players create and play characters (adventurers) who live their imaginary lives in a specially made game world. The game world is created, managed and operated by a GameMaster (GM), referee, or dungeon master (DM).

Most people who play role playing games use a formal rule system. Some of the best known are shown below.

***Bushido.** Fantasy Games Unlimited, P.O. Box 182, Roslyn, NY 11576.*

***Champions.** Hero Games, 92A 21st Avenue, San Mateo, CA 94402.*

***Dungeons & Dragons (D&D).** TSR, P.O. Box 756, Lake Geneva, WI 53147.*

***RuneQuest (RQ).** Avalon Hill, 4517 Harford Road, Baltimore, MD 21214.*

***Star Trek.** FASA, P.O. Box 6930, Chicago, IL 60680.*

***Tunnels & Trolls (T&T).** Blade, P.O. Box 1467, Scottsdale, AZ 85252.*

Beginners beware! The rule books are formidable. If you are a beginner, we suggest you start with one of the following books, both from Reston Publishing Company, 1480 Sunset Hills Road, Reston, VA 22090.

***Adventurer's Handbook: A Guide to Role Playing Games** by Bob Albrecht and Greg Stafford.*

*You will also need **Adventurer's Handbook** if you play our play-by-mail beginner's game. We call it DragonFun.*

Copyright© 1985 by DragonQuest, P.O. Box 7627, Menlo Park, CA 94026.

Role playing games can include anything possible in real life plus anything anyone can imagine. Perhaps the kids who create, explore and manage these "worlds of if" will be the creative managers, explorers, movers and shakers a few years from now.

Fortunately, everyone has the number one ingredient required to play a role playing game: imagination. Add paper and pencil, a few dice, a rule book or two, and you are ready to play. We will help. In "GameMaster's Apprentice," we will try to answer questions such as:

— What are role playing games?
— Why are they so popular?
— What are the most popular games?
— How are the games played?
— What can be learned while playing?
— What can be learned while preparing to play?
— Parent: How can I use knowledge about role playing games to relate better to my children?
— Teacher: How can I use knowledge of role playing games to relate better to my students?

Most role playing game players play one or more games from the following categories:

— Low-technology worlds where magic works. The culture is similar to medieval Earth plus magic that works. These are the worlds of swords and sorcery.

Arthur and Merlin lived in such a world. Tolkien created this kind of world. *Bushido, Dungeons & Dragons, RuneQuest* and *Tunnels & Trolls* are in this category.

— Contemporary technology worlds, perhaps with the addition of superheroes. Examples are *Champions, SuperWorld, Marvel Superheroes* and *Mercenaries & Spies*.

— Future technology worlds. Explore our galaxy, or another galaxy, in games such as *Star Trek* or *Traveller*.

We know that some of you who read "GameMaster's Apprentice" are players. What games do you play? What are your favorite games?

We hope some of you are non-players who want to learn more about this incredible subculture. How can we help you learn? Would it help if we described a game system each time (for example, *Dungeons & Dragons*)?

Aloysious Continues on His Journey

Aloysious is traveling afoot from his village to the town of Baldvu on a warm, clear spring day. Here again are his characteristics and success percentages for the three skills described last time.

Characteristics		Skills	Percent
STR	10	Listen	45
CON	11	Spot Hidden Item	25
SIZ	10	Move Quietly	25
INT	12		
POW	10		
DEX	12		
CHA	9		

Last time, Aloysious spotted the hidden deer, but was unsuccessful in his attempt to quietly move closer to it. The deer bounded away; Aloysious sighed and resumed his journey.

HIDE — Success percentage: 55%

In a dangerous spot, perhaps Aloysious should hide instead of trying to sneak away. His chances of hiding are much better than his chances of moving quietly away.

Success: Roll 55 or less on the percentile dice
Failure: Roll 56 or more on the percentile dice

Aloysious hears a boisterous bunch of dwarves coming down the path. He hides. We roll 42; they don't see him. Whew!

Or use your CoCo to simulate the percentile roll.

A digit die (DD) is a 10- or 20-sided die whose faces are numbered 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

D100 is a percentile roll, with numbers 00 to 99. To make a percentile roll, use one DD (digit die) and roll it twice. The first roll is the tens digit; the second roll is the ones digit. If you roll a '3' the first time and a '7' the second time, the number is 37.

JUMP — Success percentage: 45%

Only 45 percent? Yes, we know everyone can jump. In this case, Aloysious has a 45 percent chance to jump:

1) Across a ditch about four meters wide.
2) Up, up and over something one meter high.
3) Down from a place four meters high without falling and possibly getting hurt.

If he fails, he falls into the ditch (let's hope it is shallow), trips over something and falls on his face, or lands in a heap while jumping down. He might get hurt doing this and take a few hit points.

Success: Roll 45 or less on the percentile dice
Failure: Roll 46 or more on the percentile dice

You guessed it. Aloysious is still meandering down that path through the forest. He comes to a somewhat deep and fast-moving stream about eight meters wide. There is a large rock showing in the middle of the stream. Aloysious doesn't feel like trying to swim across, so he tries to jump to the rock. He figures he can cross the stream in two jumps.

Roll the dice: 00. Oops! That's a fumble. Aloysious's foot hits the rock and slips off. He bangs his knee, scrapes his arm, bounces his chin off the rock and plunges into the cold, rushing water.

The GameMaster solemnly intones "1D6 hit points." We roll 1D6 and get three. His clothing absorbs one point, so we mark off two hit points on his character sheet.

SWIM — Success percentage: 20%

Aloysious will win no swimming medals. He is reasonably adept, however, in at least keeping his head above water. He has a 20 percent chance of swimming directly across the creek with only a little downstream drift.

Success: Roll 20 or less on the percentile dice
Failure: Roll 21 or more on the percentile dice

Like it or not, Aloysious has gone swimming. As he strikes out for the other side of the creek, we roll the dice and get 33. Looks like Aloysious will have to go with the flow.

A couple of hundred meters downstream, the creek deposits a watersoaked, bruised and exhausted Aloysious on (fortunately!) the far shore. Gratefully, he rests and dries out in the warm sunshine.

Again we leave Aloysious to dry out, rest and recover. Next time, he will continue his trek to Baldvu.

Play-By-Mail Games

If you have never played a role playing game and want to begin playing, try a play-by-mail (PBM) game. Anyone can learn to play by playing — no previous gaming experience is required.

Flying Buffalo, Inc. created the play-by-mail industry. We have played or are playing four of their games: *Nuclear Destruction, Heroic Fantasy, Starweb* and *Feudal Lords*. If you are a beginner, try *Nuclear Destruction* or *Heroic Fantasy* for starters. As you gain experience, move on to

Starweb and *Feudal Lords*. Begin by getting the rules from Flying Buffalo, Inc., Dept. GMA, P.O. Box 1467, Scottsdale, AZ 85252-1467. Here are the prices: *Nuclear Destruction* $.25, *Starweb* $2, *Heroic Fantasy* $1 and *Feudal Lords* $1. There is a set-up fee to enter a game and a turn fee each time you send in a move. It's all there in the rules.

Heroic Fantasy

We are playing *Heroic Fantasy* by mail and began reporting our progress in the January 1985 issue of THE RAINBOW. Here is our team of adventurers.

Name	Sex	Code	Kindred	Class*	STR	CON	Cost
Ai Khong	M	H	Hobbit	F	5	15	5
Frona	F	H	Hobbit	F	5	15	5
Mariko	F	H	Hobbit	M	4	15	7
Steffi	F	H	Hobbit	M	4	15	7
Sheri	F	P	Human	F	15	30	9
Zamora	M	P	Human	M	10	30	11
Tindil	M	E	Elf	F	25	25	15
Leiko	F	E	Elf	M	20	25	18
Jonjari	M	D	Dwarf	F	30	40	23
TOTALS					118	210	100

*Class: F=Fighter, M=Magic-User

Our characters are now in the Dusty Room.

Dusty Room
Doors: North 5, East 25, South 3, *West 3*.
Monster: Brown Bear.
P204: Potion

Last time, Ai Khong and Frona picked up two potions which turned out to be healing potions. The Brown Bear attacked Frona and inflicted eight hit points of damage. Her CON is now down to seven. A character called Point Man has arrived from the South, wounded with 10 hit points. He is character number C214, a male human fighter.

We have decided to give the following orders.

— Sheri: X0N. Exit using strength zero through the North door.
— Zamora: T5P204. Take, using strength 5, the potion labeled P204.
— Tindil: G20C57. Guard, using strength 20, character C57, who happens to be Zamora.
— Leiko: X0N. Exit using strength zero through the North door.
— Ai Khong: UP186C214. Use potion P186 (healing) on character C214 who is Point Man, apparently from another team of adventurers. We are going to be as friendly as possible in the game!
— Frona: UP145 X0N. Use (on herself) healing potion P145, then exit using strength zero through the North door.
— Mariko: No orders. We are holding her "in reserve."
— Steffi: X0N. Exit using strength zero through North door.
— Jonjari: X0N. Exit using strength zero through North door.

We filled out an order sheet, adding some things for our characters to say, and sent it to Flying Buffalo's computer. Here are the results.

Character	ID	Orders
Sheri	C27	X0N
Zamora	C57	T5P204: Tindil, guard me as I get the potion.
Tindil	C139	G20C57: Back off, bear!
Leiko	C141	X0N: Our intentions are peaceful.
Ai Khong	C141	UP186C214: You are healed, friend.*
Frona	C146	UP145 X0N: Our aim is to explore.
Mariko	C153	: What do I do now?
Steffi	C163	X0N: Jonjari, you go first.
Jonjari	C191	X0N: Respect our peaceful intentions, or beware!

*Character C214 is Point Man, who entered the Dusty Room injured.

Wonder what will happen next. Will the Brown Bear attack? What is beyond the North door?

DragonSmoke and *DragonFun*

DragonSmoke is our monthly newsletter about new ways to learn, including computers, role playing games, play-by-mail games, COPY ME stuff, public domain instructional materials, software for beginners, and our own play-by-mail game, *DragonFun*.

DragonFun is a play-by-mail role playing game for beginners. It is nonviolent and features cooperation, exploration, problem-solving and story-telling. How to play is described in *DragonSmoke*. For a free copy, send a business-size, self-addressed envelope with 39 cents postage to *DragonSmoke*, P.O. Box 7627, Menlo Park, CA 94026.

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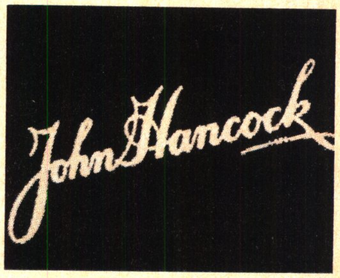

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16K
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The World's Easiest Database

By Fred B. Scerbo
Rainbow Contributing Editor

(Editor's Note: If you have an idea for the "Wishing Well," submit it to Fred, c/o THE RAINBOW. *Remember, keep your ideas specific, but don't forget that this is* BASIC. *Sorry, no personal responses are possible. All programs resulting from your ideas are for your use, but remain the property of the author.)*

This month's listing will be short and simple, but will have many uses for both home and school. I am sure many of you have seen listings for database programs many times in the past. Quite often, you will find ads for database programs that will require 64K and a disk drive. Too often, you must read pages and pages of instructions just to get your feet wet. Well, for those who thought using a database was only for the advanced programmer or user, we now have *MiniData*, a simple and short BASIC database that even a child could use.

The Wish

You have probably seen me mention that many readers and friends have always approached me or others with a very basic misconception about what a computer can do. How many times have I said that someone has made a remark like, "I want to get a computer so I can dump all this information into it and then pull it out when I need it!" Some people really think a computer is a device which you can reason with in English by telling it, "Give me the names of all my friends who own Beta VCRs" or "How much money did I make in overtime in the last two weeks?"

Granted, a computer *can* answer those questions, but *only* if a program has been devised to arrive at those answers, provided it is given accurate information by the user. Too often, a person will buy a computer to keep track of something only to find the software available will not do that.

Radio Shack does have a very simple database called *Personafile* which does a nice job of keeping track of items under the heading of "subjects" and "tags," but this can only be used for the most general type of sorting by title. I happen to like *Personafile*, but unless you have a disk drive, you are out of luck.

Recently, several readers have written requesting a type of database which could be used with the MC-10. My first reaction was, "You've got to be kidding!" Although I have tried to make as many of my programs as possible work on the MC-10, this seemed like a little too much of a task to handle.

I started to rethink my position on that request just a few months ago. There are some things which cannot be done with an MC-10, such as high resolution graphics. I have been able to generate some Lo-Res graphics games for it, but handling information in a database just did not seem to be practical with the type of keyboard the MC-10 has. However, since more and more of my mail has

---

(Fred Scerbo is a special needs instructor for the North Adams Public Schools. He holds a master's in education and published some of the first software available for the Color Computer through his software firm, Illustrated Memory Banks.)

been thanking me for not forgetting our little "CoCo Jr.," I felt there just might be a way.

The Challenge

The final stimulus which led to creation of *MiniData* came from a couple of teachers who teach for our Chapter 1 Remedial Reading Program at the high school. Both Mickey and Jeri come into my Resource Room at least once a week with a debugging problem or a small request to help them with their Apple IIe computers.

Just a few weeks ago, they came to me with a new challenge. Since they run a reading program, they have obtained a large number of small books for their students to read, all at different reading levels. They were both looking for a quick way to get a program that would let them keep track of titles, but also select them by grade level or subject, or some other characteristic by which they could identify the book. This was to be nothing complex — they just wanted a quick way to keep track of this information.

Naturally, the old MC-10 and CoCo request came to mind. You can imagine their surprise when I came back with their completed program less than 20 minutes later! The most interesting thing about the listing I gave them was that it was only about 25 lines long. Even in Applesoft, which usually takes many more lines than Microsoft BASIC to complete a task, the program was very short. The big question is: Would it work?

Without getting into too great detail, the listing did everything they wanted it to do. They could enter book titles with subjects and characteristics, then pull any title by searching for a given subject or characteristic.

What made the program so easy to use was that I would let them enter the information in DATA statements, which can be edited much more easily than a file. (Besides, knowing I would probably translate the Apple version to our BASIC since the MC-10 does not have disk capability, an easy storage media would be needed. Saving the entire program with the DATA in it would be much more efficient than loading a tape file. MC-10 does not have a tape on and off relay as the CoCo does.)

Seeing how easily the program works on the Apple, I had no difficulty translating it to Color BASIC and MC-10 BASIC. Naturally, I added a few small frills so as to make the program look attractive on your CoCo or MC-10 screen.

I also included the option of making a hard copy to the line printer. (Those with the MC-10 will have to change the lines with `PRINT#-2,` to `LPRINT` in the few lines that it appears, such as lines 350 and 450.)

The actual CoCo and MC-10 version is only 49 lines long, excluding the REM statements. I have deliberately kept each line short, usually under two screen lines. This will be useful to those of you who wish to type it into the MC-10, which does not have a built-in EDIT command. (Please, do not suggest that I find a way to add this command to the MC-10!)

How it Works

Since I have arranged this program to READ from your DATA statements, it is necessary to understand what kind of infomation the computer will be looking for. The program will always search for two "flags." (A flag is a string or number which the program will recognize so as to branch out of a READing loop before your get an ?OD Error.)

In this case, our flags are the words END and STOP. END will tell the program that you have completed a category. STOP will tell the program you have READ all the available DATA. You will notice that DATA STOP is found in the last line of the program, Line 9999. This will ensure that you always have at least the final flag in your program. (You could use a higher line number, but 9999 sounds good enough for now.)

Therefore, we must construct our DATA lines starting at Line 1000. We may put as many as 20 items in any given category we create. Any information we place prior to the word END will be included in our list for a given category.

Look at Line 1000 in our program. I have included examples using book titles and certain characteristics of those books. Our first book is *The Cat in the Hat*. The information I wish to keep on that book includes charateristics such as "Kids," "Illustrated" and "Fiction."

You will also notice that I have added the characteristic "All." This is included so you may easily scan through all the files you put in the database by searching for All.

The last piece of information in the DATA line is our flag, END. This tells the program that this is all the information under the book title or category *The Cat in the Hat*.

You will notice that the next DATA line includes similar information under the book title *The Little Train That Could*. If we were to search for titles based on the information found in these DATA lines, then the title which is our first piece of DATA would be listed for us.

Running the Program

Let's say you type in the program exactly as listed with my sample DATA. On running the program, the screen would ask:

```
WOULD YOU LIKE HARDCOPY? (Y/N)
```

Pressing 'Y' would dump the screen contents to your line printer, which must be turned on and loaded with paper. The next question will be:

```
ENTER ITEM TO SEARCH FOR:
```

Let's say we wish to search through our DATA for all the books which are for Kids. If we enter Kids, then the screen will clear and print:

```
THIS CATEGORY CONTAINS A MATCH:
> THE CAT IN THE HAT
PRESS <I>NFO OR <C>ONTINUE
```

If we press 'I' for info, the screen will then list all the information stored for that category or title. The screen would then say:

```
PRESS <ENTER> FOR MORE
```

Pressing ENTER would cause the program to search for the next category or title containing Kids in its information.

If you press 'C' for continue, the program will just list the titles and not the information stored. This can be helpful if all you want are the titles or categories containing a specific match in the information. If you had continued to press only 'C,' the screen would print:

```
THE CAT IN THE HAT
THE LITTLE TRAIN THAT COULD
GREEN EGGS AND HAM

        ANOTHER SORT (Y/N) ?
```

This means the program has found all the matches which were saved in this program for Kids.

Let's say you search for "history." The program would search the information and then print

```
NO MATCHES FOUND!
```

because we had not listed that as information in any case. If we searched for non-fiction, you would only get one match:

```
LIFE EXTENSION
```

because it is the only example in our DATA listing which has the category non-fiction.

You may also search for a given title or category in your DATA. You are not limited to only searching for the information stored in a category. Therefore, if you search for:

```
DUNE
```

the computer would find it listed as a title and allow you to list the information stored with that category.

To put it in the simplest terms, remember that your DATA is entered in this fashion:

```
1000 DATA "title or category",
"info","info","info","ALL",END
```

END indicates the end of a category. ALL allows you to search through all the information and categories you have stored. Remember, the comma (,) is used to separate our pieces of information. You may also use more than one DATA line, but always be sure to end a category's information with ALL and END.

One-Liner Contest Winner . . .

Protect is a program which, to a certain extent, keeps "nosy people" out of your programs. Just add it to the beginning of a program.

The listing:

```
10 A$(2)=CHR$(126):A$(3)=CHR$(96
):FORX=1TO480:Y=RND(2)+1:PRINTA$
(Y);:POKE65314,248:NEXTX:FORL=1T
O999999:NEXTL
```

Doug Hemphill
Agoura, CA

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape*.)

Many Uses

Once you understand the format explained, you can use *MiniData* to keep track of almost anything. One reader requested a program to save recipes. *MiniData* could do that. Have your category be the dish (i.e., banana creme pie) and in the data, list all the ingredients. Since you have 20 categories to work with, you could even include the instructions in the final lines. This way, you could store pages of recipes on tape or disk, and actually dump the instructions to paper with a line printer when you need it. (No one that I know of cooks with a computer screen near the stove.)

MiniData could be used to keep track of odd jobs completed, additional income, valuables and their serial numbers, and so on. No disk is needed, although you can save on disk just as easily as on tape. Just save the whole program, but be sure to use different program names for different information listings (such as recipes or income).

This program should offer many people a simple introduction to a database program. I hope with this listing its use is explained sufficiently. It just goes to show that simplicity can often be the best solution to a programming problem.

Quick Fix

Several months ago I listed a program called *HOMONYMS* which was a limited multiple choice-type quiz using only two choices. Some people have found this program useful for reviewing material other than homonyms. Therefore, for those who wish to use the program for math or history or some other subject, here are three DATA lines that will replace the word "homonym" in the title card with the word "practice" so the quiz title will appear as PRACTICE QUIZ. Just replace the three lines in the original with the three below and you will have the newer version.

```
150 DATA ,239,236,239,,239,236,2
39,,231,236,235,,239,236,236,,23
6,239,236,,228,239,232,,239,236,
236,,239,236,
160 DATA,239,236,236,,239,237,22
6,,239,236,239,,239,224,224,,224
,239,224,,224,239,224,,239,224,2
24,,239,236,
170 DATA,236,224,224,,236,224,23
6,,216,224,236,,236,236,236,,224
,236,224,,228,236,232,,236,236,2
36,,236,236,
```

Be sure to save this new version under the title *PRACTICE* after you make any other modifications, such as references to homonyms in the PRINT statements.

Some readers also wrote in regarding an error they believe they found in *Demon's Defiance*. It seems that some versions of the CoCo do not recognize the PEEK(339) as a joystick location. (My TDP does.) For those who have found difficulty using the joystick with *Demon*, substitute this line:

```
680  IFPEEK(65280) <> 255 AND PEEK(65280) <>
127 THEN780
```

or try:

```
680 PK=PEEK(65280):IF PK=254 OR PK=126 THEN 780
```

Both should work. I chose the location 339 because it involves fewer BASIC characters to be read, making a faster program. Again, these are not errors. Every now and then we find some differences between the Radio Shack ROMs. Thanks to all who wrote in on this.

On *Tri-Hang*, the space version of *Tri-Planetary Hangmenoids*, those wishing to use the easy level may find it convenient to `EDIT` Line 1200 and insert:

```
1200 DL=7:
```

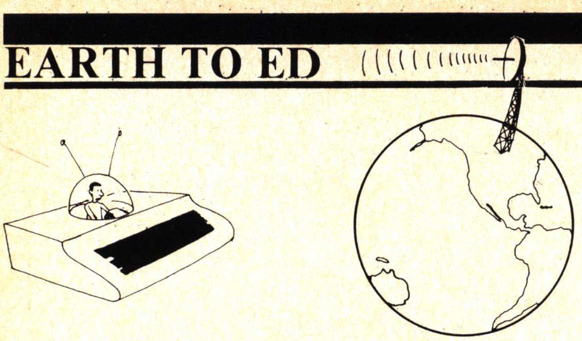
just before the `IF/THEN` statement. This seems to be a better place to put it.

280 95
490 156
END 120

The listing: `MINIDATA`

```
10 REM**************************
20 REM*  MINI COLOR DATABASE  *
30 REM*   BY FRED B. SCERBO   *
40 REM*    149 BARBOUR ST.    *
50 REM* NORTH ADAMS, MA 01247 *
60 REM*  COPYRIGHT  (C) 1985  *
70 REM**************************
80 CLS
90 CLEAR500
100 FORI=1TO16:BK$=BK$+CHR$(8)+C
HR$(8)+CHR$(8)+CHR$(8):NEXTI
110 PRINT@134,"MINI COLOR DATABA
SE"
120 PRINT@175,"BY"
130 PRINT@201,"FRED B. SCERBO"
140 PRINT:PRINT
150 PRINT" WOULD YOU LIKE HARDCO
PY? (Y/N)"
160 X$=INKEY$:IFX$=""THEN160
170 IFX$="Y"THEN P=1:GOTO200
180 IFX$="N"THEN P=0:GOTO200
190 GOTO160
200 PRINT:PRINT"    ENTER ITEM T
O SEARCH FOR:"
210 PRINT:PRINT"    =>";
220 LINEINPUT CT$
230 DIM T$(20):M=0
240 CLS
250 READ A$:I=1:T$(I)=A$:IF A$="
STOP"THEN520
260 IF A$="END"THEN510
270 IF A$=CT$ THEN T$(I)=A$:GOTO
320
280 FORI=2TO20
290 READ SR$:IF SR$="END"THEN510
300 T$(I)=SR$:IF SR$=CT$ THEN320
310 NEXTI:GOTO250
320 IF X$="C"THEN340
330 CLS:M=1:PRINT"THIS CATEGORY
CONTAINS A MATCH:"
340 PRINT "> "T$(1)
350 IF P=1 THEN PRINT#-2,TAB(5)T
$(1)
360 PRINT
370 PRINT"===PRESS <I>NFO OR <C>
ONTINUE===";
380 X$=INKEY$:IFX$=""THEN380
390 IF X$="C"THEN500
400 IF X$="I"THEN420
410 GOTO380
420 FOR Z=I+1 TO 20:READ A$:IF A
$="END"THEN440
430 T$(Z)=A$:NEXTZ
440 FOR K=1 TO Z-1:PRINT T$(K)
450 IF P=1 THEN PRINT#-2,TAB(10)
T$(K)
460 NEXTK
470 PRINT"=====PRESS <ENTER> FOR
 MORE====="
480 X$=INKEY$:IFX$<>CHR$(13)THEN
480
490 GOTO510
500 PRINTBK$;
510 GOTO250
520 IF M=0 THEN CLS:PRINT@135,"N
O MATCHES FOUND !"
530 PRINT:PRINT"       ANOTHER SO
RT (Y/N) ?"
540 X$=INKEY$:IFX$=""THEN540
550 IF X$="Y"THEN RUN
560 IF X$="N"THEN CLS:END
570 GOTO540
990 REM ENTER DATA AT LINE 1000
1000 DATA "THE CAT IN THE HAT","
KIDS","ILLUSTRATED","FICTION","A
LL",END
1010 DATA "THE LITTLE TRAIN THAT
 COULD","KIDS","COLOR","ILLUSTRA
TED","FICTION","ALL",END
1020 DATA "GREEN EGGS AND HAM","
KIDS","COLOR","PAPERBACK","FICTI
ON","ALL",END
1030 DATA "RETURN OF THE JEDI","
OLDER KIDS","COLOR","ILLUSTRATED
","FICTION","ALL",END
1040 DATA "STAR WARS","OLDER KID
S","COLOR","ILLUSTRATED","AVAILA
BLE ON TAPE","FICTION","ALL",END
1050 DATA "TARZAN OF THE APES","
OLDER KIDS","VIOLENT","NON-ILLUS
TRATED","FICTION","ALL",END
1060 DATA "DUNE","YOUNG ADULT","
DIFFICULT","NON-ILLUSTRATED","FI
CTION","ALL",END
1070 DATA "LIFE EXTENSION","NON-
FICTION","HEALTH","ADULT","ALL",
END
9999 DATA STOP
```

EARTH TO ED



More On MIDIs

By Ed Ellers
Rainbow Technical Writer

That letter we ran from Gareth Jones back in April asking about the Musical Instrument Digital Interface system seems to have touched a nerve; I've gotten a couple of different responses to his question. (By some coincidence, this is our annual Music Issue. Will wonders never cease?) Here they are:

- *The major problem I can see is that a special hardware interface has to be built. I can only think of two sources that can give Gareth all he needs to design and build the MIDI interface for the CoCo: PAIA Electronics and Polymart, both in Oklahoma City. The addresses are:*

PAIA Electronics, Inc.
P.O. Box 14359
Oklahoma City, OK 73114

Polymart
P.O. Box 20305
Oklahoma City, OK 73156

Gareth might also be interested in Polyphony *magazine, available through PAIA.*

Rob Rosenbrock
Bluffton, IN

- *I have waited since 1983 for the software and hardware to play my Roland JX3P synthesizer from my CoCo. I finally got tired of waiting and wrote my own software and built the interface myself. It is simple enough that anyone who has the skill to make his own RS-232 cable can build it. The software was written in* C *and runs under OS-9.*

Naturally, I think I have a very useful package for people like Mr. Jones and myself, so I am trying to interest a distributor, and for that reason I won't go into the details except to say that thanks to the speed of the CoCo's 6809 CPU, the project is 99.44 percent pure software. If no one seems willing to buy it, I'll make the package available somehow to interested computer musicians.

Dave McFadden
Tulsa, OK

For those of you whose hands-on experience with synthesizers is limited to those keyboards you see in the department stores, if you have any interest at all in making music you haven't lived until you've seen and heard what the new digital synthesizers can do using MIDI.

I went to a music store recently and heard several MIDI-linked systems in action, and it was a real eye-opener. The Apple II and Commodore 64 (in addition to Yamaha's new CX5M MSX computer) can be interfaced to MIDI now, and the upcoming Atari ST will have a MIDI port, so when someone brings out a CoCo-MIDI interface, CoCo will be joining some fast company.

Poor Colors

- *I have an original CoCo with a 'D' Board. I have never been able to obtain the eight colors the computer is supposed to generate. When I first bought the computer, I hooked it to an old color TV and I thought that was the problem. However, I now have it hooked up to a monitor with the same results.*

The red is a dark shade of blue, for instance, and the magenta is also a shade of blue. None of the colors are what they should be. I replaced the VDG chip, thinking this might be the problem, but that did no good at all.

Herman L. Smith
Olean, NY

The problem is probably that the computer's master clock is out of adjustment. Adjusting it will be a bit tricky. First, you'll have to set up your TV or monitor for best reception on a local station's color bar pattern; the standard colors from left to right are white, yellow, cyan, green, magenta, red and blue. (When a monitor is involved you will need to arrange some way of feeding a local TV signal into it; a VCR's video output is a good source.)

Next, put up blocks of several colors on the CoCo and adjust the trimmer

---

(Ed Ellers, a RAINBOW *and* PCM *staff member, is a self-confessed electronics fanatic whose other interests include science fiction.)*

capacitor (C4 on a 'C,' 'D' or 'E' Board) to get the correct colors. If you turn it too far you will lose all color; just turn it back.

RGB vs. NTSC

• *I know that a monitor will improve the quality of displays on the CoCo, but how do I make an intelligent selection without "overbuying" for the capability of my CoCo?*

1) *What is the difference between RGB and composite video?*
2) *Can the CoCo output RGB signals?*
3) *Is RGB any better than composite, display-wise?*
4) *Could you explain screen pixels, bandwidth and dot pitch?*
5) *Would a good color monitor give you the same number of characters as a monochrome monitor?*

Robert Jobin
Theodore, AL

1) Composite video is the term for a single signal that contains all the necessary information to reproduce a picture. RGB is a system that sends separate red, green and blue signals to the monitor (vertical and horizontal sync are often separate as well).

2) The CoCo was designed from the beginning to work with standard TV sets, and getting the necessary signals out is rather difficult.

3) RGB does provide much better resolution than composite color because all the information is transmitted in full. Composite color restricts the amount of color information transmitted.

4) Pixels (picture elements) are the dots that make up the picture. Bandwidth is a measure of how much information can be transmitted through the circuit; in monitors, bandwidth determines how sharp the picture will be. Dot pitch is the distance between adjacent dots or stripes on the face of a color picture tube; the narrower the pitch is, the sharper the resulting picture will be.

5) A really good color monitor with a fine dot pitch (like .31 mm) would show all the characters that most computers (and certainly the CoCo) can put out. Most composite color monitors, sadly, use the same picture tubes as home TV sets and don't have such good resolution. One (very expensive) monitor that does is Sony's KX-1201HG, which sells for around $800.

Printer Switcheroo

• *Can I modify my Tandy/Radio Shack DMP-110 printer so I can switch select the various print fonts without having to send the specific control codes from the computer?*

Richard C. Buescher
Madison, WI

From the schematic you sent, I don't see how, since there aren't any switches inside the printer to set up default settings. On many printers (like Epson), you can wire switches across the DIP switch contacts, but you would have to turn the printer off and then back on after setting the switches in order for the printer to recognize the new settings.

Printer Graphics

• *I have a DMP-110 printer and have no clue as to where I might find a screen dump program. Can you help me?*

Beau Palmer
Costa Mesa, CA

Radio Shack's *Hi-Res Screen Print Program* should work fine.

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Grade 3 Spelling	90-5208	Cassette	$8.95
	90-5209	Disk	$10.95
Grade 4 Spelling	90-5210	Cassette	$8.95
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Getting Better Acquainted With The DRAW Statement

By Joseph Kolar
Rainbow Contributing Editor

You should have enjoyed getting acquainted with DRAW last month. Rather than making pointless boxes (R4D4L4H4) or equally meaningless diamonds (H4E4F4G4), you created useful letters of the alphabet.

As a follow-up, here is a puzzle for you to break the ice. Use the DRAW statement to make a square inside of a diamond. All units of both the square and the diamond must be of the same length and the square must touch the elements of the diamond. If you plot it out on a sheet of paper, you can work it out easily enough. If you try it as a mental exercise, you are apt to discover that several attempts are necessary before you succeed.

There is nothing a beginner can do wrong when s/he sits in front of the keyboard and bangs away. Even a mistake is not detrimental, provided something is learned from it. In fact, it is the best way to learn.

If you key in Listing 1, you will see that the program is geared to run in PMODE4. For purposes of experimental programs, where color is not an overriding factor, the finer detail of PMODE4 is ideal to observe the work in progress as you create.

A few words concerning Listing 1: Lines 20 and 30 place the letters 'A' through 'O' on the top screen line. Line 30 has no instructions to CoCo, such as size, color or starting location. CoCo reads this line as "keep going," since it has no new instructions that supercede the ones in Line 20 (S8BM20,70).

Note that the first letter created by Line 30 is 'I' and CoCo locates it right after the last letter, 'H,' in Line 20. Can you imagine the frustration of picking up the horizontal coordinate to determine where Line 30 should begin? For the heck of it, insert your guess in Line 30 (BMx,70) after the opening ", where 'x' is your guess. See how quickly you can pick up the location that CoCo has reserved to save you the bother. Line 40 centers the balance of the alphabet below the first line.

Notice these two rows of the alphabet have the vertical lines in either red or blue. The colors will vary from TV set to TV set or monitor.

Line 50 draws and centers the numerals on the bottom line. They should be in red if the letters of the alphabet are in blue or in blue if the letters of the alphabet are red. In all three rows of text, the horizontal lines will be in the buff color of the screen. The diagonal lines are a repeating combination of red and blue or red and green.

If you press the Reset button and RUN, you may find that the alphabet swapped colors with the numerals. If they did not, repeat this procedure. Sometimes CoCo is cranky and doesn't cooperate immediately!

If you want to make all the lines the same color, change the horizontal coordinate in Line 50 from 65 to either 64 or 66. One unit more or less won't affect the centering significantly. Now RUN, then to get the other color, press Reset until CoCo cooperates.

Look over the letters of the alphabet. They were created on a 6 by 4 matrix, except for 'I,' 'M' and 'W,' to be as simple as possible. Each letter in the listing was separated by a space for your convenience. The only letter with rounded corners is 'D' to tell it apart from 'O.' You could round off parts of 'A,' 'B,' 'C,' 'D,' 'O,' 'P,' 'Q,' 'R' or 'S,' which are customarily cursive, to become more elegant.

The more elegant the alphabet, the more troublesome it is to create and utilize. The only elegant feature is the "tick" mark on numeral '1,' which makes it a 6 by 2 matrix.

(Joseph Kolar is a free-lance writer and programmer dedicated to proselytizing for computers in general, and the CoCo specifically.)

If you want to make all the vertical lines the same color in S8 or S16, use either all even or all odd numbers in every line that has a horizontal locating coordinate (e.g.: Line 20 <21>, Line 40 <61>, Line 50 <65>). Now, BREAK and remove the `REM` marker from Line 15 and `RUN`.

This sentence uses five additional spaces to separate words, BR8, instead of the usual BR3 used to separate letters.

You may want to copy lines 200 through 270, letter by letter, on graph paper to get the feel of how each letter "flows" from one to the next. The letters may connect at the top or the bottom, depending where the next letter begins, thus avoiding extra moves.

This is not to say that you should not return to the lower left-hand corner of the 6 by 4 matrix of the next letter. You may find it easier to do so. If so, try to recreate the sentence so every letter begins in the same spot of the matrix (lower left corner).

Observe Line 280 and BREAK. Now, change S8 to S12 and `RUN`. Both verticals of 'A,' 'N' and 'O,' and a small vertical of 'B' are the wrong color. We want all the vertical lines in "RAINBOW" to be the same color as the sentence.

Make the following changes in Line 280: BREAK and change the BR3 at the end of 'R' to BR4, then `RUN` and BREAK. Change the BR3 at the end of 'A' to BR4, then `RUN` and BREAK. Change the BR3 at end of 'I' to BR4, then `RUN` and BREAK. Change the BR3 at the end of 'N' to BR4 and `RUN`.

The 'B' must be redrawn to eliminate the mismatched color in the top part. This is a hard one! Again, a compromise must be made. Redraw 'B' to read U6R3FDGNL3FD2NL4BR4; `RUN` and BREAK. Change BR3 at the end of 'O' to BR4 and `RUN`. Now it is OK!

Remember, you must make one correction at a time and check to see where the next correction must be made. In the case where one side of a letter is one color and the other side is in the second color, you may correct this by making the letter one unit wider. (A 6 by 4 matrix letter is changed to a 6 by 5 matrix format.)

You can BREAK and change S12 back to S8 and discover that both sizes have become stable.

For practice, delete Line 280 and create your own word using S12 size and then adjust it so it will be the same color as the sentence.

We found out some interesting things, didn't we? Since we are too new at computing to understand or worry about "why" something happens, we remain content to become familiar with "what" happens. Let us experiment together to see what we can determine about `PMODE4` with `SCREEN 1,1`.

This is the sort of experimentation you are urged to try. You never know what insights you may gain or what avenues of exploration may be uncovered. Hopefully, we will know a bit more when we finish this study than we know now.

Type `NEW` and key in lines 0,10 and 100 of Listing 2. First, we will draw two diagonal lines to cover the screen. Key in Line 20 using the `DRAW` statement.

> ***"This is the sort of experimentation you are urged to try. You never know what insights you may gain . . . "***

We tell CoCo to draw a line in C1, beginning at locations BM0,0, moving diagonally down and to the right-hand corner (F255); next, to go to the lower left-hand corner without drawing a visible line, BL255; then draw a line diagonally up and to the right-hand corner, E255, and `RUN`. Examine the lines. You should see that the lines are composed of three different, repeating, colored dots.

Usually these lines are put on the screen using the `LINE` statement. You can check this out by putting a `REM` marker in front of `DRAW` in Line 20. Key in Line 30 without the `REM` marker and `RUN`. You have exactly the same thing. Comparing lines 20 and 30 of the listing proves that using `DRAW` is quicker and simpler than using `LINE`.

For the record, note that `DRAW"C1BM0,0F255` is equal to `LINE(0,0)-(255,191),PSET:` and `BL255` is equivalent to `LINE-(0,191),PRESET:` and `E255` does the same as `LINE-(255,0),PSET`.

We decide to check out the vertical lines and picking one at random, we instruct CoCo to draw a line 50 units from the left margin at the top down to the bottom. Key in `40 DRAW"BM50,0D191` and `RUN`. We get a red line. If you get a blue or green line, press Reset until it turns red for the purpose of our study, then BREAK, add BR1 (same as BR), and draw a line back to the top, smack dab next to the first line! Did you add U191? Now `RUN`.

This results in a nice blue line. Press BREAK and move two spaces or units to the right and draw a line to the bottom of the page, BR2D191, and `RUN`. We get a greenish line; now BREAK and move three units to the right and draw a line to the top, BR3U191, and `RUN`. Now we get a red line. Hit BREAK and let's move four units to the right and draw a line to the bottom, BR4D191, and `RUN`. This gives us a green line.

Continue to move right, incrementing "+1" each time and draw an appropriate line up or down. Run after each addition to Line 40 (refer to the listing).

When you are finished, can you draw some conclusions? When do you get red lines? Green lines? How can you change the last red line on the right to that nice blue color? How about that last green line? Hint: At the end of Line 40, add BL12U191, `RUN`, BREAK, then add BR13D191 and `RUN`. Did you expect that?

What do you suspect will happen when you tell CoCo to begin at either 49 or 51 units from the left margin? Try both and see! Does that tell you anything? Suppose you added a third line next to the last one (BR1U191), then what? You get the idea! Continue with these vertical lines until you run out of possibilities.

After your interest is exhausted in the vertical lines, let us go back to work and check out the horizontal lines. Tell CoCo where to begin. Key in `50 DRAW"BM0,80` to start at the left margin 80 units from the top and draw a line to the right margin: R255 and `RUN`. Aha! A buff line. Let us put a line just below it and see what happens: BD1L255 and `RUN`. Nothing much!

Continue with the balance of Line 50, adding one line at a time, making the space between units "+1" wider each time (refer to Line 50). When finished, what conclusions can you draw?

In Line 60, we decide to draw a box in an unused area of the screen. Key in Line 60. We decide to make a larger box surrounding the small box. Key in Line 70 and `RUN`. You should have a nested pair of boxes with red horizontal lines and buff vertical lines.

Suppose we painted it? Would color 1 (C1) stop at both the red and buff borders? And, what color would we get?

Let's paint the area between the big box and the small box. Key in Line 80 without the REM marker and RUN. We get the buff color. Now BREAK and insert the REM marker in front of Line 80.

Just to double-check, let us try to paint the triangle that encloses the boxes. Let us see if it butts up against the hypotenuse (diagonal line). Key in Line 90 without the REM marker and RUN. When you are finished reinsert the REM marker.

Make any further tests that you can dream up. If you haven't gotten food for thought and discovered any new insights, RUN and consider the display as modern art.

You should have gained a lot of respect for DRAW. You should have gained some insights about experimenting; hardly a day at the keyboard should go by without learning something new about CoCo. We may never become experts, but let's have fun practicing and experimenting. Next month, we'll make some designs with DRAW.

210 196
END 193

Listing 1: LISTING 1

```
0 'LISTING1
10 PMODE4,1:PCLS:SCREEN1,1
15 'GOTO200
20 DRAW"S8BM20,70U6R4D4NL4D2BR3
U6R3D3NL3RD3NL4BR3 NR4U6R4BR3 ND
6R3FD4GNL3BR4 NR4U3NR3U3R4BR3 NR
4D3NR3D3BR7 NR4U6R4BD4NL2D2BR3 U
4NU2R4NU2D4"
30 DRAW"BR3NU6BR3 NUR4NU6BR3  U3
NU3RNE3F3BR3 NU6R4BR3 U6F3E3D6BR
3 U6F4NU4D2BR3 NR4U6R4D6BR3 U6R4
D3L4"
40 DRAW"BM60,90NR2U6R4D6L2NUNDBR
5 U6R4D3L3NLF3BR3 R4U3L4U3R4BR3
R2ND6R2BR3 D6R4U6BR3 D4F2E2U4BR3
 D6E3F3U6BR3 DF2G2DBR4UH2E2UBR3
D2F2ND2E2U2BR3 R4DG4DR4"
50 DRAW"BM65,110BRU6NGBR3 R4D4L4
D2R4BR3 R4U3NL3U3NL4BR3D4R3NRNU4
D2BR4 R4U4L4U2R4BR3 D6R4U3NL4BE3
 R4D6BR3 NR4U4NR4U2R4D6BR7 U6L4D
3R4BF3 NR4U6R4D6"
100 GOTO100
200 DRAW"S8BM20,60U6R4D4NL4D2BR8
 R4U3L4U3R4BR3ND6BR3 ND6F3E3D6BR
3 U6R4D3NL4BE3 D6R4BR3 NR4U3NR3U
3R4BF6BR2"
210 DRAW"U6R4D4NL4D2BR3NU6R4BR3
U6R4D3NL4BF3 U3NU3R5NU3D3BR3 U6R
4D4NL4D2BR3 U6R3D2NL3RD4NL4BR3 N
R4U3NR3U3R4BR3 R2ND6R2"
220 DRAW"BM10,80U6BR3 NR4D3R4D3N
L4BR10U6NL2R2BR3 D3ND3R5ND3U3BR3
 NR4D3NR3D3R4BR8 U6R3D2NL3RD4NL4
BR3 NR4U3NR3U3R4BR3 NR4D3R4D3NL4
BR6 U6NL2R2BR3"
230 DRAW"BR5ND6R4D4NL4D2BR3 NU6R
4BR3 U6R4D3NL4BR3 ND3NU3R4NU3D3B
R3 U6R4D4NL4D2BE3R3"
240 DRAW"BM10,100U6R3D2NL3RD4NL4
BR3 NR4U3NR3U3R4BR3 R2ND6R2BR8 R
2ND6R2BR2 NR4D6R4NU6BR8 NR4U6R4B
D4NL2D2BR3 NR4U3NR3U3R4BR3 R2ND6
R2BR8"
250 DRAW"D2F2ND2E2U2BR3 NR4D6R4U
6BR3 D6R4NU6BR3 U6R4D3L3NLF3"
260 DRAW"BM10,120U6F3E3D6BR3 NR4
U3NR3U3R4BR3 NR4D3R4D3NL4BR3 R4U
3L4U3R4BR3 ND6R4D4NL4D2BR3 NR4U6
R4BD4NL2D2BR3 NR4U3NR3U3R4BR8"
270 DRAW"ND6R4D4NL4D2BR3 NR4U6R4
BR3 ND6R4D3L3NLF3BR3 NR4U6R4D6BR
3 R4U3L4U3R4BR3 NR4D3R4D3NL4BR4
UBU2U3"
280 DRAW"S8BM50,160U6R4D3L3NLF3B
R3 U6R4D4NL4D2BR3 NU6BR3 U5NUF4N
U5DBR3 U6R3D2NL3RD4NL4BR3 NR4U6R
4D6BR3 NU6E3F3U6"
1000 GOTO1000
```

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WARNING — YOU MAY BECOME ADDICTED

Listing 2: LISTING 2

```
0 'LISTING2
10 PMODE4,1:PCLS:SCREEN1,1
20 'DRAW"C1BM0,0F255BL255E255"
30 LINE(0,0)-(255,191),PSET:LINE
-(0,191),PRESET:LINE-(255,0),PSE
T
40 DRAW"BM50,0D191 BR1U191BR2D19
1BR3U191BR4D191BR5U191BR6D191BR7
U191BR8D191BR8U191BR9D191BR10U19
1BR11D191BR12U191BR13D191BL12U19
1BR13D191BR1U191"
50 DRAW"BM0,80R255BD1L255BD2R255
BD3L255BD4R255BD5L255"
60 DRAW"S8BM220,50R5D5L5U5"
70 DRAW"BM210,70R15U15L15D15"
80 'PAINT(213,68),1,1
90 'PAINT(240,77),1,1
100 GOTO100
```

Bonus listing: CLOVER

```
0 'CLOVER
10 '(C) 1984, J. KOLAR
30 PMODE3:PCLS:PMODE4
40 A=90:B=86:R=76:P=1.70
50 DIM S(7),T(7)
60 CIRCLE(8,8),8,1:CIRCLE(7,7),8
,1
61 DRAW"BM8,6NL3NR3NU3ND3NE3NF3N
G3H3"
70 GET(0,0)-(16,16),S,G
72 CIRCLE(38,8),6,1:PAINT(40,8),
1,1
73 GET(30,0)-(46,16),T,G
80 PCLS:SCREEN1,1
90 FOR Q=.15 TO .05 STEP -1
100 FORZ=1TO7.16 STEPQ:C=Z
110 C=40+(C)+R*P*90
115 K=COS(R/2)*COS(C)*SIN(C)
120 X=INT(A-6+R*COS(C)):Y=INT(B-
8+R*SIN(K))
130 PUT(X+36,Y+10)-(X+52,Y+26),S
,OR
135 PUT(X+36,Y+10)-(X+52,Y+26),T
,AND:SOUND100,1
140 X=INT(A-6+R*SIN(K)):Y=INT(B-
8+R*COS(C))
150 PUT(X+36,Y+8)-(X+52,Y+23),S,
 OR
155 PUT(X+36,Y+8)-(X+52,Y+23),T,
AND:SOUND100,1
160 NEXT Z,Q
170 PLAY"V2003L8CO2AFAO3L16CAFAA
FACV15L8FAAFV10L4C":GOTO90
```

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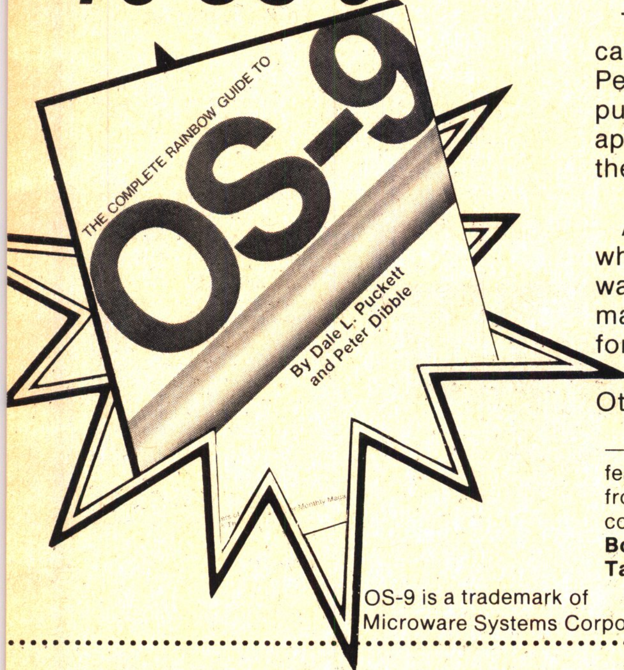
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Test your music and memory skills . . .

Guess Right, Guess Wrong — Name That Song!

By Mel Richardson

(Editor's Note: This program has been submitted by Mel Richardson, Irene Erwin and the Gifted/Talented Class at Meadow Homes School in Concord, Calif. Under Mr. Richardson's guidance, it was developed by the 19 students of this class.)

Mel Richardson instructed the Gifted/Talented Class for eight and one-half months. He brought his own computer for the students to use and prepared lessons the entire time. He taught all the students BASIC computer language and instructed them in programming techniques. None of the students had previous experience in the use of the computer.

In eight and one-half months, the students progressed from the simplest operations to completing two games for use on the TRS-80. At first, many of the students were reluctant even to touch the computer, but as time progressed, many of them became quite proficient. The growth in their knowledge is very evident and extremely exciting. It is particularly refreshing to see students have a chance to develop some expertise in this field.

Program Instructions

The game, *Name That Song*, was developed over a period of about three months after the students had become comfortable with the use of the computer. Since none of us knew much about music, it was a learning experience for all. We had to learn the names of notes, the value of each note and in which octave to place the notes. Students searched for music they felt would be recognized easily, then programmed the music.

Name That Song consists of an introduction which asks for player number one's name (seated on the left side of the computer using the up-arrow key), then asks for player number two's name (seated on the right side of the computer using the right-arrow key). After a moment's pause, the computer will play one note and give each of the two contestants an opportunity to name the song by pressing his or her respective arrow. If they cannot name the song after one note, an additional note is added after each try up to a total of 15 notes before the computer names the song.

Points are scored for a correct answer and deducted for a wrong answer. The game may be terminated at any time by pressing 'E.' Score and winner will be shown at the end of the game. The computer gives simple, easy-to-follow directions throughout the game.

Graphics were produced to highlight the game, then tried out on a class of students who had not participated in the program. It was an instant success; soon there was a room full of students who wanted a chance to try their skills. For many students, this was the first time they had even touched a computer, but the excitement was contagious. Hopefully, more students will have an opportunity to participate in computer education programs in the future.

(If you have any questions, please call or write Mr. Richardson, 2925 Monument Blvd., Apt. 115, Concord, CA 94520, phone (415) 671-7053.)

(Mel Richardson teaches BASIC to gifted and talented elementary school children. He attended San Francisco State University.)

200	103	2940	166
520	30	3160	149
780	121	3410	7
940	76	3650	228
1200	255	3870	65
1480	53	4130	171
1700	190	4440	247
1980	111	4700	209
2220	61	END	186
2480	26		

The listing: NAMESONG

```
10 POKE 65495,0
20 CLEAR 1000
30 CLS:Y=0:X=0
40 NY$="BR20D20L6H12D12L6U20R6F1
0U10R6"
50 AY$="R20D20L4U8L12D8L4U20D8BR
4R12U4L12D4BL4U8R20"
60 MY$="R20D20L4U16L4D16L4U16L4D
16L4U20R20"
70 EY$="R20D4L16D4R16D4L16D4R16D
4L20U20R20"
80 TY$="R20D4L8D16L4U16L8U4R20"
90 HY$="BR20D20L4U8L12D8L4U20R4D
8R12U8R4"
100 BY$="BR5"
110 TX$="R28D8L8D20L12U20L8U8R28
"
120 UX$="BR28D28L28U28R8D20R12U2
0R8"
130 NX$="BR28D28L8U4H12D16L8U28R
8F12U12R8"
140 EX$="R28D8L20D4R20D4L20D4R20
D8L28U28R28"
150 MZ$="D16U16R8D16U16R8D16U16"
160 EZ$="D16R16BU8L16U8R16"
170 AZ$="D16BR16U8L16U8R16D8U8"
180 DZ$="D16R12E4U8H4L12R12BR4"
190 OZ$="D16R16U16L16R16"
200 WZ$="D16R8U16D16R8U16"
210 HZ$="D16U8R16D8U16"
220 SZ$="D8R16D8L16BU16R16"
230 CZ$="D16R16BU16L16R16"
240 LZ$="D16R16BU16"
250 CA$="D12R12BU12L12R12"
260 OA$="D12R12U12L12R12"
270 NA$="D12BR12H12BR12D12U12"
280 RA$="D12U4R8D4U4R4U8L12R12"
290 DA$="D12R8E4U4H4L8R8"
300 LA$="D12R12BU12"
310 AA$="D12U6R12D6U12L12R12"
320 IA$="D12U12"
330 FA$="D12U6R8L8U6R12"
```

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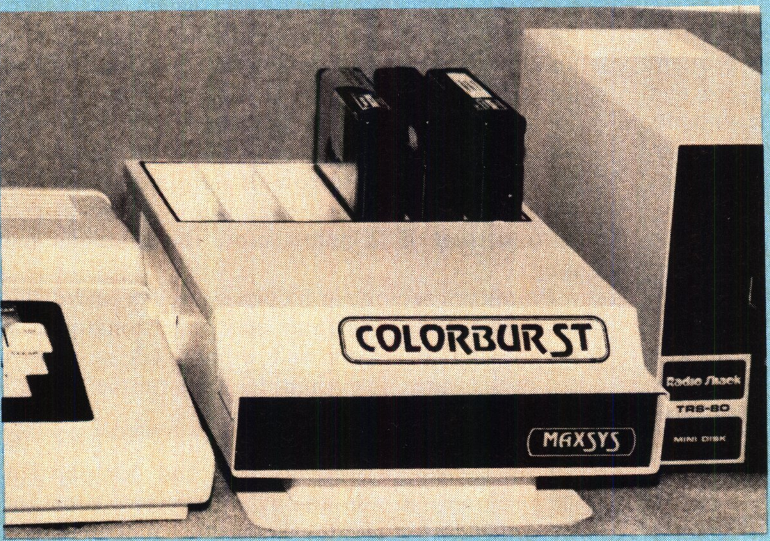

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```
340 A$="O2L8CCFFFFFFEFGP2"
350 B$="CCGGGGGGFGAP2"
360 X$=A$+B$
370 R$="CEP8CEP8CEP4P8"
380 S$="CEFEDP8FP4P8"
390 PMODE 3,1
400 PCLS2
410 SCREEN 1,0
420 Y$=X$+R$+S$
430 DRAW "BM40,12;"+NY$
440 XY$="BM+6,0"
450 QY$="BM+4,0;"
460 DRAW XY$+AY$+QY$+MY$+QY$+EY$
+QY$+BY$+TY$+QY$+HY$+QY$+AY$
470 DRAW"BM212,12;"+TY$
480 DRAW"BM64,44;"+TX$
490 QX$="BM+4,0;"
500 DRAW QX$+UX$+QX$+NX$+QX$+EX$
510 DRAW"BM4,108;"+MZ$
520 QZ$="BM+6,0;"
530 DRAW QZ$+EZ$+QZ$+AZ$+QZ$+DZ$
+QZ$+OZ$+QZ$+WZ$
540 DRAW"BM140,108;"+H$
550 DRAW QZ$+HZ$+QZ$+OZ$+QZ$+MZ$
+QZ$+EZ$+QZ$+SZ$
560 DRAW"BM68,132;"+SZ$
570 QZ$="BM+6,0"
580 DRAW QZ$+CZ$+QZ$+HZ$+OZ$+QZ$
+OZ$+QZ$+LZ$
590 DRAW"BM28,172;"+CA$
600 QA$="BM+6,0"
610 DRAW QA$+OA$+QA$+NA$+QA$+CA$
+QA$+OA$+QA$+RA$+QA$+DA$
620 DRAW"BM164,172;"+CA$
630 DRAW QA$+AA$+QA$+LA$+QA$+IA$
+QA$+FA$
640 PAINT(42,14),0,0
650 X=66:Y=14:O=0
660 PAINT(42,14),0,0
670 PAINT(X,Y),O,0
680 P=P+1
690 X=X+24
700 IF P<3 THEN 670
710 IF P=3 THEN X=142:O=1
720 IF P<7 GOTO 670
730 X=66:Y=46
740 PAINT(X,Y),4,0
750 X=X+34
760 IF X>168 THEN 780
770 GOTO 740
780 PLAY X$
790 T$=INKEY$:IF T$="" THEN 790
```

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```
800 WW$="D20F4U20H4R4F4D16R8H4L4
R4U16F4D16U16H4R4F4D16R8H4L4R4U1
6F4D16U16H4R4F4D20L28R28U20H4"
810 RR$="D20F4U20H4R28F4L28R28D1
2L4D8L8U8L4D4F4BL8L8R8U8R4L4BL4B
U4U4R20D4H4F4L20BR24U8H4"
820 OO$="D20F4U20H4R28F4L28R28D2
0L28R4BU4U12R20D12H4U8D8L16D4R20
BR4U16H4"
830 NN$="D20F4U20H4R8F4L8R8F12U1
2H4D12U12R8F4D20L8H16D16L4BR28U2
0L8R8H4"
840 GG$="D20F4U20H4R28F4D4L24D12
R20H4F4U4L20R8H4U4F4D4U4R16D12L2
8R28U12H4F4BU4U4L28R28H4"
850 TT$="D4F4U4H4R28F4L28D4R12BR
4R12U4D4L12D16L4U16L4D12F4U16BR4
R12U4H4"
860 EE$="D20F4U20H4R28F4L28D20R2
8U4L24U4R20F4H4R4U4L24U4R20F4H4R
4U4H4"
870 CC$="D20F4U20H4R28F4D4L24D12
U4R20F4L24R24D4L28R28BU16U4L28R2
8H4"
880 CLS:PRINT@ 225,"FIRST PLAYER
S NAME";
890 INPUT T$(2)
900 Q$(6)="T2"
910 CLS:PRINT@225,"NEXT PLAYERS
NAME";
920 INPUT U$(2)
930 PRINT@2,T$(2);T;"     ";U$(2)
;U
940 A$="L4T5CEFL1GP4L4EFL1G"
950 B$="P4L4CEFL2GECEL1D"
960 C$="P8L4EEDL2CL4CL2E"
970 D$="L4GGGL1FL4EF"
980 E$="L2GEL4CL8DD+EGL4AL1O3C"
990 Q$=A$+B$+C$+D$+E$
1000 Q$(1)="TBJOUT"
1010 Q$(8)="XIFO@UIF@TBJOUT@HP@N
BSDIJOH@JO"
1020 GOSUB 3780
1030 GOSUB 3240
1040 A$="T2O2L8BBL4BL8BBL4BL8BO3
DL4O2GL16GL2BO3L8CCCC"
1050 B$="L8CO2BBL16BBL8BAABO2L4A
O3DO2L8BBL4B"
1060 C$="L8BBL4BL8BO3DO2L4GL16AL
2BO3L8CCL4CL16C"
1070 D$="L8CO2BBL16BBO3L8DDCO2AL
4G"
1080 Q$=A$+B$+C$+D$
1090 Q$(1)="CFMMT"
1100 Q$(8)="KJOHMF@CFMMT"
1110 GOSUB 3780
```

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```
1120 GOSUB 3240
1130 A$="T3O3L4CO2AO3L2C"
1140 B$="L4DCO2B-AGAL2B-"
1150 C$="O3L4CO2FL8FFL4FL8FGAB-L
1O3C"
1160 D$="O3L4CO2GGB-AGL2F"
1170 Q$=A$+B$+C$+D$
1180 Q$(1)="NBO"
1190 Q$(8)="UIJT@PME@NBO"
1200 GOSUB 3780
1210 GOSUB 3240
1220 A$="O2L4GGAL2F#L8GL4A"
1230 B$="L4BBL4O3CL2O2BL8AL4G"
1240 C$="L4AGF#L2G"
1250 D$="O3L4DDDL2DL8CO2B"
1260 E$="O3L4CCCL2CO2L8BL4A"
1270 F$="L4BO3L8CO2L8BAGL4BO3L8C
L4D"
1280 G$="L8ECO2L4BAL2G"
1290 Q$=A$+B$+C$+D$+E$+F$+G$
1300 Q$(1)="BNFSJDB"
1310 Q$(8)="BNFSJDB"
1320 GOSUB 3780
1330 GOSUB 3240
1340 A$="O2L8B-B-O3CDO2B-O3DL4CO
2L8B-B-O3CDO2L4B-A"
1350 B$="L8B-B-O3CDE-DCO2B-AFGAL
4B-B-"
1360 C$="L8GAGFGAL4B-L8FGFE-L4DF
"
1370 D$="L8GAGFGAB-GFB-AO3CO2L4B
-B-"
1380 Q$=A$+B$+C$+D$
1390 Q$(1)="ZBOLFF"
1400 Q$(8)="ZBOLFF@EPPEMF"
1410 GOSUB 3780
1420 GOSUB 3240
1430 A$="O2L8AGFGAAL4AL8GGL4GL8A
O3L8CL4C"
1440 B$="O2L8AGFGAAAAGGAGL2F"
1450 Q$=A$+B$
1460 Q$(1)="NBSZ"
1470 Q$(8)="NBSZ@IBE@B@MJUUMF@MB
NC"
1480 GOSUB 3780
1490 GOSUB 3240
1500 A$="O2L2DDL4DL8EL2F#L4F#L8E
L4F#L8GL2AP8"
1510 B$="O3L8DDDO2L8AAAF#F#F#DDD
L4AL8GL4F#L8EL2D"
1520 Q$=A$+B$
1530 Q$(1)="SPX"
1540 Q$(8)="SPX@SPX@SPX@ZPVS@CPB
U"
1550 GOSUB 3780
1560 GOSUB 3240
1570 A$="O2L4GGGDEEL2DL4BBAAL2GP
4L4DGGGDEEL2DL4BBAAL2GP4"
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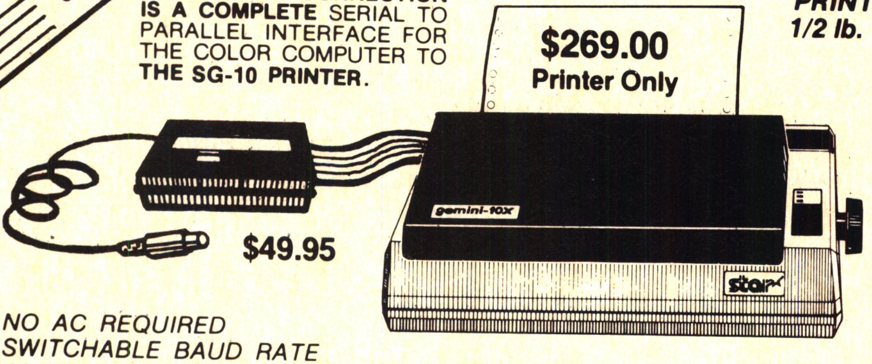

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1580 B$="L8DDL4GGGL8DDL4GGL2GL8G
GL4GL8GGL4GL8GGGGL4GGGGGDEEL2DL4
BBAAL1G"
1590 Q$=A$+B$
1600 Q$(1)="GBSN"
1610 Q$(8)="PME@NBD@EPOBME@IBE@B
@GBSN"
1620 GOSUB 3780
1630 GOSUB 3240
1640 A$="O2L4FGAFFGAFAB-O3L2CO2L
4AB-"
1650 B$="O3L2CL8CDCO2L8B-L4AFO3L
8CDCO2L8B-"
1660 C$="L4AFFCL2FL4FCL2F"
1670 Q$=A$+B$+C$
1680 Q$(1)="KBDRVFT"
1690 Q$(8)="GSFSF@KBDRVFT"
1700 GOSUB 3780
1710 GOSUB 3240
1720 A$="T3O2L4FGAL2B-L1B-L4B-FG
L2AL1A"
1730 B$="L4CFAL2GL1GL8GGL4FGL2AL
1A"
1740 C$="L8FFL4GAL2B-L1B-L8B-B-L
4FGL2AL1A"
1750 D$="L4GL2GL4GGL2EL8CL4EGL1F
"
1760 Q$=A$+B$+C$+D$
1770 Q$(1)="MBOE"
1780 Q$(8)="UIJT@MBOE@JT@ZPVS@MB
OE"
1790 GOSUB 3780
1800 GOSUB 3240
1810 A$="O2L8CCL4DCFL2E"
1820 B$="L8CCL4DCGL2F"
1830 C$="L8CCO3L4CO2L4AFEL2D"
1840 D$="L8B-B-L4AFGL2F"
1850 Q$=A$+B$+C$+D$
1860 Q$(1)="CJSUIEBZ"
1870 Q$(8)="IBQQZ@CJSUIEBZ"
1880 GOSUB 3780
1890 GOSUB 3240
1900 A$="O2L4CEL8...GL8EL4GAL2G"
1910 B$="L4EGL1AL2G"
1920 C$="L4EGL8...GL8EL4FEL2D"
1930 D$="L4CDL2EDL4C"
1940 Q$=A$+B$+C$+D$
1950 Q$(1)="CPBU"
1960 Q$(8)="NJDIBFM@SPX@UIF@CPBU
@BTIPSF"
1970 GOSUB 3780
1980 GOSUB 3240
1990 A$="O2L4GL8...GL8EL4EGL8...
GL8DL4DEFGAO2BL4...GL4G"
2000 B$="L8...GL8EL4EGL8...GL8DL
4DO3L4DC#DEO2L4AO3L4...DO2L4G"
2010 C$="O3L8...EL8EL4DL4CL8...C
O2L8BL4BO3L4CDO2L4BAGO3L4...C"
2020 D$="L4CL8...CO2L8AL4AO3CL8.
..CO2L8GL4GGAO3L4CO2GO3DL4...C"
2030 Q$=A$+B$+C$+D$
2040 Q$(1)="BNFSJDB"
2050 Q$(8)="BNFSJDB@UIF@CFBVUJGV
M"
2060 GOSUB 3780
2070 GOSUB 3240
2080 A$="O1L8B-O2L4E-L8E-L4FL8FG
B-GL4E-"
2090 B$="O1L8B-O2L4E-L8E-L4FL8FL
4.GE-"
2100 C$="L4E-L8E-L4FL8 FGB-GL4.E
-"
2110 D$="O3L8CP2O2L4FL8A-L4.GE-"
2120 Q$=A$+B$+C$+D$
2130 Q$(1)="QPQ"
2140 Q$(8)="QPQ@HPFT@UIF@XFBTFM"
2150 GOSUB 3780
2160 GOSUB 3240
2170 A$="O2L8...GL8AL4GL1E"
2180 B$="O3L2DL4DO2L1B"
2190 W$="O3L2CL4CO2L2.G"
2200 C$="L2AL4AO3L8...CO2L8BL4AL
8...GL8AL4GL2.E"
2210 D$="O3L2DL4DL8...FL8DO2L4BO
3L1CL2E"
2220 E$="L8...CO2L8GL4EL8...GL8F
L4DL1.C"
2230 Q$=A$+A$+B$+W$+C$+C$+D$+E$
2240 Q$(1)="OJHIU"
2250 Q$(8)="TJMFOU@OJHIU"
2260 GOSUB 3780
2270 GOSUB 3240
2280 A$="O2L4.EDL2.C"
2290 B$="L4.GL4FL8FL2.E"
2300 C$="O3L4CL8CO2BABO3CO2L8GL4
GL8G"
2310 D$="O3L8CCCO2BABO3L4CO2L8GL
4GL8G"
2320 F$="O3L8CCCO2BABO3L8CO2L8GG
GAFL4.EDL2.C"
2330 Q$=A$+A$+B$+B$+C$+D$+F$
2340 Q$(1)="UISFF"
2350 Q$(8)="UISFF@CMJOE@NJDF"
2360 GOSUB 3780:GOSUB 3240
2370 A$="O2L8...GL8AL4GFEFL2G"
2380 B$="L4DEL2FL4EFL2G"
2390 C$="L2DGL4EL2C"
2400 Q$=A$+B$+A$+C$
2410 Q$(1)="MPOEPO"
2420 Q$(8)="MPOEPO@CSJEHF@JT@GBM
MJOH@EPXO"
2430 GOSUB 3780:GOSUB3240
2440 A$="O2L4CCEGO3L2.CO2L1AL4AF
GAL1G"
```

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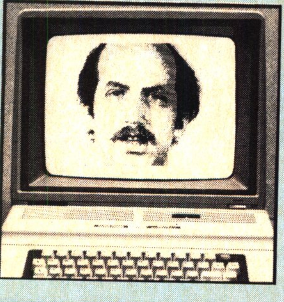

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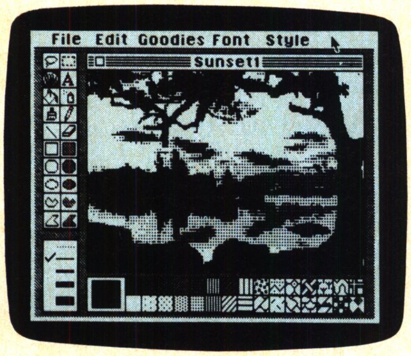
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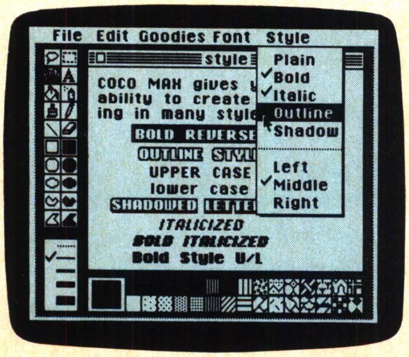
We are all witnessing an exciting revolution in microcomputers: a radically new kind of computer and software that opens a whole new world of creative power to computer users.

It was inevitable that this exciting approach would be brought to the CoCo. With this in mind, Colorware chose to go all out and maximize this new concept for the color computer. That meant designing not just software but hardware too. It meant thousands of hours of pure machine language programming. Rarely has this much effort been applied to one product for the Color Computer.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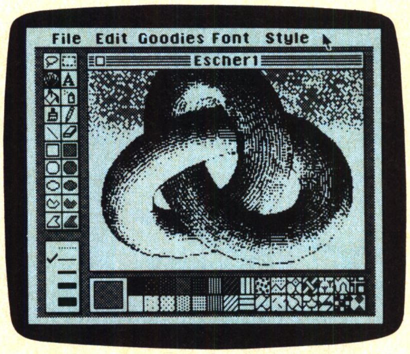
style
COCO MAX gives y
ability to create
ing in many style
BOLD REVERSE
OUTLINE STYL
UPPER CASE
lower case
SHADOWED LETTE
ITALICIZED
BOLD ITALICIZED
Bold Style U/L
Plain
✓Bold
✓Italic
Outline
Shadow
Left
✓Middle
Right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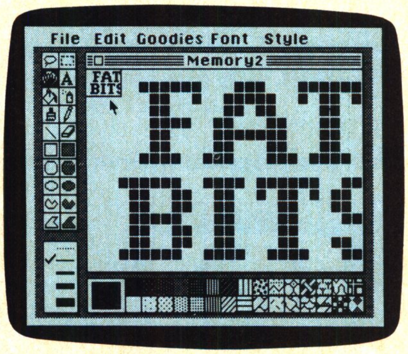
UNMATCHED CAPABILITY...

Because we took the maximum approach: highly optimized machine code combined with hardware, CoCo Max truly stands above the rest as the ultimate creative tool for the Color Computer. It's unrivaled performance lets you create with more brilliance and more speed than any similar system – much more than you ever imagined possible. And, you can do it in black & white or color.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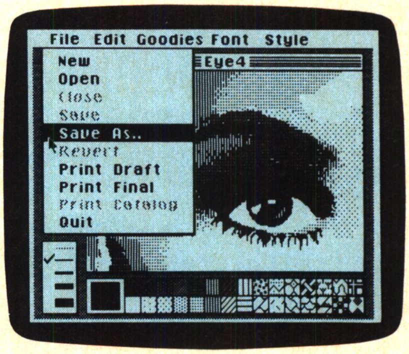
Memory2
FAT BITS
FAT
BITS

All the sophisticated power of the bigger systems is there: ***Icons, Pull-Down Menus,*** full ***Graphic Editing, Font Styles,*** and all kinds of handy tools and shortcuts.

Plug your joystick, mouse or touch pad into CoCo Max's Hi-Res Input Unit. Then use a delightfully simple ***Point-and-Click*** method to get any of CoCo Max's powerful graphic tools. It has them all: You can ***Brush, Spray*** or ***Fill*** with any ***Color, Shading*** or ***Pattern.*** Use ***Rubber Band Lines*** and ***Shapes*** (square, rectangle, circle, elipse, etc.) to create perfect illustrations with speed and ease. There's a ***Pencil,*** an ***Eraser*** and even a selection of ***Caligraphy Brushes.*** And, as you can see, CoCo Max can do a lot with text.
All of the newest special effects are there: ***Trace Edges, Flip, Invert, Brush Mirrors,*** etc. And all of the very latest supercapabilities like: ***Undo,*** which automatically reverses your mistakes, and ***Fat Bits*** which zooms you way in on any part of your subject to allow dot-for-dot precision.


File Edit Goodies Font Style
New
Open
Close
Save
Save As..
Revert
Print Draft
Print Final
Print Catalog
Quit
Eye4

THE BIG PICTURE

The large image box in the middle of the CoCo Max screen is actually only a window on an even larger image. Use the Point-and Click "Hand" to effortlessly move your window over any portion of the larger image. You have a working area of up to 3-½ times the area of the window itself.

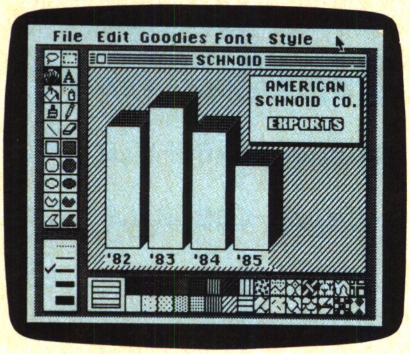
FLEXIBLE PRINTING...

CoCo Max gives you many ways to print. Fill a whole page with your image or condense two full CoCo screens to less than ¼ page for a finely detailed copy. "Dump" your CoCo Max screen full size or shrink it to ⅛ page size.

THE COCO MAX SYSTEM

FREEDOM TO CREATE...

Anyone who wants to create anything at all on their CoCo screen or printer will certainly be very glad to meet CoCo Max. CoCo Max's friendly yet sophisticated graphic and text capabilities let you almost instantly produce illustrations, diagrams, charts,



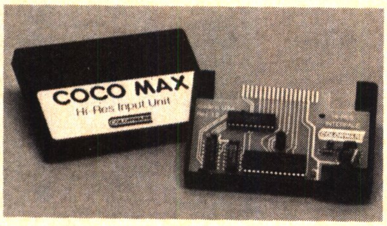
graphs, and computer art – for serious use or just for creative fun.

AN ABSOLUTE GUARANTEE

CoCo Max is a hardware/software system that no software-only system can match. Get CoCo Max and see your CoCo perform as it never could before. If you don't agree that CoCo Max is the ultimate creative tool for the Color Computer, simply return it within 20 days for a full, courteous refund from Colorware.

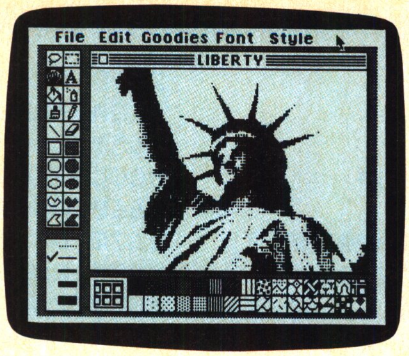
THE HARDWARE...

This is the key to CoCo Max's unmatched performance. Did you know the normal joystick input built into the Color Computer only allows access to 4,096 (64 x 64) points on the CoCo screen? Yet, the Color Computer's high resolution screen



has 49,152 (256 x 192) pixels. This means that a joystick, mouse or even a touch pad can, at best, only access about one tenth of the pixels on the CoCo screen.

Most graphic programs ignore this hardware limitation of the Color Computer and give you only low-res control. Others attempt to overcome the limita-



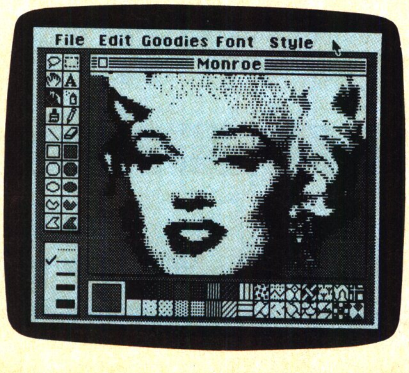
tion by using software schemes such as sliding windows. Although clever, these schemes yield sluggish and awkward results. Only CoCo Max does it the right way. The CoCo Max Hi-Res Input Unit plugs into your ROM slot and adds an entirely new joystick input to your computer – a precision one with a 49,152 point resolution to match the CoCo screen exactly.

Plug your same joystick, mouse or touch pad into this new input and you have a whole new kind of control. The difference is remarkable.

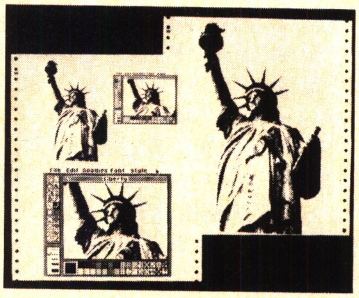
COCO MAX
CoCoMax

A DIGITIZER OPTION...

We studied all the video digitizers available and picked the best of them to link with CoCo Max. The DS-69 from Micro Works was our choice. This optional device lets you capture the image from any video source (video recorder, camera, etc.) on your Color Computer.



You may then use CoCo Max's graphic magic on it. The DS-69 is available as an option from Colorware from $149.95 complete with its own software on disk or tape. Using the DS-69 with a disk requires an RS multi-pak adaptor.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COCO MAX REQUIREMENTS

The CoCo Max System includes the Hi-Res Input Unit, software on disk or cassette (please specify) and user manual. It will work on any 64K Extended or non-extended Color Computer. You'll need a Radio Shack or equivalent joystick, mouse or touch pad. Disk systems require a Multi-Slot Interface or Y-Branching Cable.

THE COMPLETE COCO MAX SYSTEM, with software on *DISK*........... ***$69.95***

with software on *CASSETTE* (Available Mar '85)......................... ***$69.95***

Y-BRANCHING CABLE-If you have a disk system but do not have a Multi-Slot Interface, use this economical 40-pin, 1 male, 2 female cable to connect the CoCo Max Hi-Res input unit and your disk controller to your CoCo..... ***$27.95***

Sorry, COCO MAX is not compatible with JDOS

COLORWARE

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```
2450 B$="L4CCEGL2.GL1D"
2460 C$="L8DEL4FEDL1C"
2470 D$="L8DEL4FEDL1C"
2480 Q$=A$+B$+C$+A$+B$+D$
2490 Q$(1)="UPQ"
2500 Q$(8)="PO@UPQ@PG@PME@TNPLZ"
2510 GOSUB 3780:GOSUB 3240
2520 A$="O2L8...GL8DL16...L16DL1
6...GL16AL2BG"
2530 B$="O3L8...CL8CO2L4GAL1B"
2540 C$="L8...GL8DL16...GL16DL16
...GL16AL2BL8...G"
2550 D$="L8GL8...AL8AL4ABL1A"
2560 E$="L8...AL8AL16...G#L16AL1
6...BL16AL2GD"
2570 F$="O3L8...CL8CO2L16...GL16
GL16...AL16AL1B"
2580 G$="L8...EL8F#L16...GL16F#L
16...GL16EL2DL8...GL8AL8...BO3L8
CO2L4BL4AL2.G"
2590 Q$(6)=A$+B$+C$+D$
2600 Q$=E$+F$+G$
2610 Q$(1)="SBJMSPBE"
2620 Q$(8)="JWF@CFFO@XPSLJOH@PO@
UIF@SBJMSPBE"
2630 GOSUB 3780:GOSUB 3240
2640 A$="O2L8AL4AL8AAGAL8...B-L4
AL8AL4GL8GGFGL8...AL4FL8G"
2650 B$="L4AL8AAGAL8...B-O3L4DL8
DCCCO2L8B-AGL8...F"
2660 Q$=A$+B$
2670 Q$(1)="KPMMZ"
2680 Q$(8)="GPS@IFT@B@KPMMZ@HPPE
@GFMMPX"
2690 GOSUB 3780:GOSUB 3240
2700 A$="O2L4CCFGL2AL8FEL4DB-B-L
2B-L8B-B-"
2710 B$="O3L2CO2L8FFL4FEFL1GL4CC
FGL2AL8FE"
2720 C$="L4DB-B-L2B-L8B-B-L8...A
L8GL4FEFGL1F"
2730 D$="O3L2.CO2L2B-L8AGL1AL8CC
L2FL8FF"
2740 E$="L4FEFL1GL4CCFGL2AL8FE"
2750 F$="L4DB-B-L2B-L8B-B-L8...A
L8GL4FEFGL1F"
2760 Q$=A$+B$+C$+D$+E$+F$
2770 Q$(1)="IPNF"
2780 Q$(8)="IPNF@PO@UIF@SBOHF"
2790 GOSUB 3780:GOSUB 3240
2800 A$="O2L4DDAAL8BBBBL2A"
2810 B$="L4GGF#F#EEL2D"
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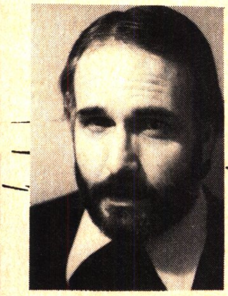

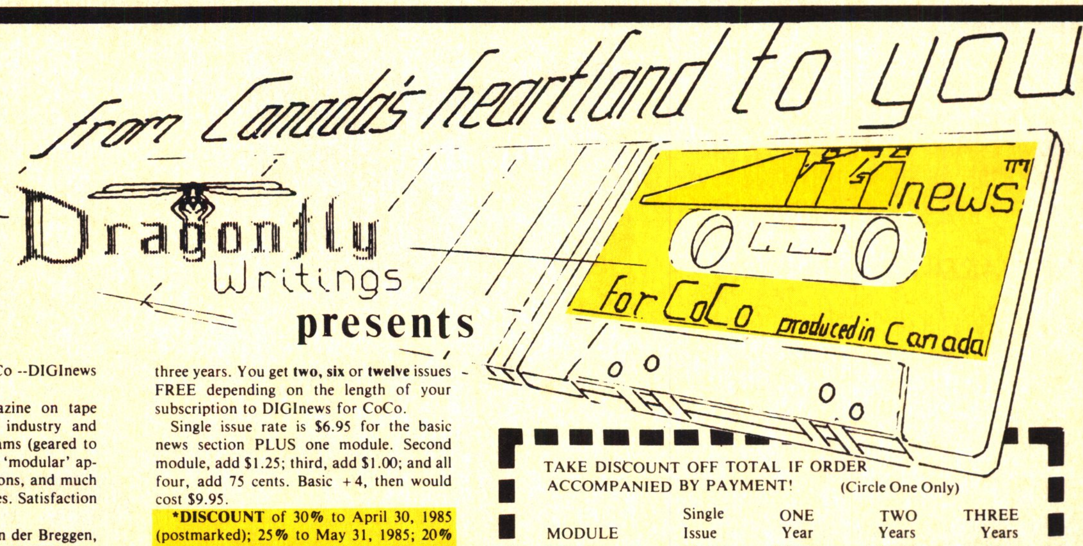
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Pieter Van der Breggen,
Dragonfly Writings.

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__Home & Family __Kids Only! __The Hobbyist __CoCo Business

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```
2820 C$="L4DL8DDL4AABL8BBL8...A"
2830 D$="L8AL4GL8GGF#F#F#F#L4EL8
EEL2D"
2840 Q$=A$+B$+C$+D$
2850 Q$(1)="CMBDL"
2860 Q$(8)="CBB@CBB@CMBDL@TIFFQ"
2870 GOSUB 3780:GOSUB 3240
2880 PLAY"T2O2"
2890 A$="O2L16...FL16DO1L4B-O2L4
DFL2B-O3L16...DL16CO2L4B-DEL2F"
2900 B$="L8FFO3L8...DL8CO2L4B-L2
AL8GAL4B-B-FDO1B-"
2910 C$="O3L8DDL4DE-FL2FL8E-DL4C
DE-L2E-"
2920 D$="L4E-L8...DL8CO2L4B-L2AL
8GAL4B-DEL2F"
2930 E$="L4FB-B-L8B-AL4GGGO3L4CL
8E-DCO2B-L4B-A"
2940 F$="L8FFL8...B-O3L8CDE-L2FO
2L8B-O3CL8...DL8E-L4CO2L2B-"
2950 Q$(6)=A$+B$+A$+B$+C$
2960 Q$=D$+E$+F$
2970 Q$(1)="CBOOFS"
2980 Q$(8)="UIF@TUBS@TQBOHMFE@CB
OOFS"
2990 GOSUB 3780:GOSUB 3240
3000 A$="O2L4FL8FFL4FL8FFL4AO3L8
CCO2L4AF"
3010 B$="L4GL8GGL4GL8GGL4GL8GGL4
EL4C"
3020 C$="O2L4FL8FFL4FL8FFL4AO3L8
CCO2L4AF"
3030 D$="O3L4CO2L8B-B-L4AGL4...F
"
3040 Q$=A$+B$+C$+D$
3050 Q$(1)="UFO"
3060 Q$(8)="UFO@MJUUMF@JOEJBOT"
3070 GOSUB 3780: GOSUB 3240
3080 A$="O2L8AL8...AL8BL4AF#DF#L
8...AL8BL4AL2F#"
3090 B$="L8DF#L2.ABL4GF#GL2E"
3100 C$="L4EL8...EL8F#L4EEC#EL8.
..GL8GL4GL2.B"
3110 D$="L4AAAL2AL4GL8...F#L8EL4
F#D"
3120 Q$(1)="CMPX"
3130 Q$(8)="CMPX@UIF@NBO@CPXO"
3140 Q$=A$+B$+C$+D$
3150 GOSUB 3780: GOSUB 3240
3160 A$="O1L16...BO2L16DL8BL4AL8
GO1L16...BO2L16DL8GL8...F#"
3170 B$="L16...CL16DO3L8CO2L4BL8
AAGEL8...D"
3180 C$="L8EDGO3CO2BL4GL8AEF#L4G
"
3190 Q$=A$+B$+A$+C$
3200 Q$(1)="CBCZ"
3210 Q$(8)="SPDLBCZF@CBCZ"
3220 GOSUB 3780: GOSUB 3240
3230 GOTO 4810
3240 P=0:P=-1:H=0:YX=0
3250 P=P+1:H=H+1:O=0
3260 IF P<0 THEN P=0
3270 CLSP
3280 IF P=>8 THEN LET P=0:P=P-1
3290 X$=LEFT$(Q$,H)
3300 T$(1)=LEFT$(Q$,H+1)
3310 P$=MID$(T$(1),H+1)
3320 IF P$="#" OR P$="-" THEN PL
AY T$(1) :YX=YX+1:GOTO 3460
3330 IF MID$(X$,H)<CHR$(65) THEN
 P=P-1:GOTO 3250
3340 IF MID$(X$,H) >CHR$(72) THE
N P=P-1:GOTO 3250
3350 PRINT@2,T$(2);T"     ";U$(2)
;U;
3360 IF P>0 THEN 3410
3370 CLS
3380 PRINT@230,T$(2);" USE UP AR
ROW";
3390 PRINT@294,U$(2);" USE RIGHT
 ARROW";
3400 FOR X=1 TO 1800:NEXT X
```

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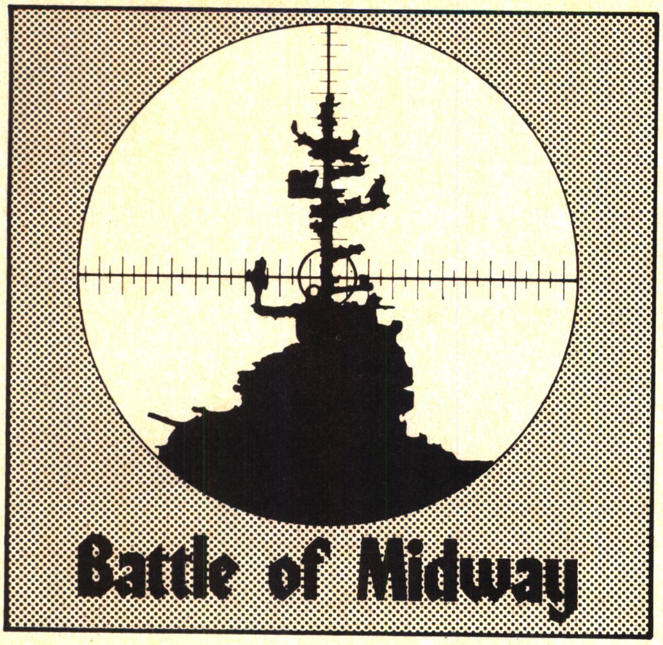
```
3410 YX=YX+1
3420 IF YX=>15 THEN 4620
3430 IF EX>7 THEN EX=0
3440 CLS:PRINT@235,"NOTE";YX;
3450 PLAY X$
3460 S$=INKEY$:O=O+1
3470 IF O=>20 THEN 3250
3480 PRINT@2,T$(2);T;"     ";U$(2
);U;
3490 PRINT@453,"TO END GAME PRES
S (E)";
3500 IF S$="E" THEN 4810
3510 IF S$=CHR$(94) THEN W$=T$(2
):GOTO 3550
3520 IF S$=CHR$(9) THEN W$=U$(2)
:GOTO 3550
3530 PRINT@2,T$(2);T;"     ";U$(2
);U;
3540 GOTO 3460
3550 PRINT@228," NAME THAT TUNE
";W$;
3560 PRINT@288," ";
3570 LINE INPUT T$
3580 IF T$="E" THEN 4810
3590 P=1:F=0
3600 F=INSTR(P,T$,Q$(1))
3610 IF F>0 THEN T$=Q$(1):GOTO 3
640
3620 IF P>N THEN 3640
3630 P=P+1:GOTO 3600
3640 IF S$=CHR$(94) AND T$=Q$(1)
THEN LET LP=1/YX*1000:T=T+INT(LP
)
3650 IF S$=CHR$(9) AND T$=Q$(1)
THEN LET LP=1/YX*1000:U=U+INT(LP
)
3660 IF T$=Q$(1) THEN 4350
3670 IF S$=CHR$(94) THEN LET LP=
1/YX*1000:T=T-INT(LP)
3680 IF S$=CHR$(9) THEN LET LP=1
/YX*1000:U=U-INT(LP)
3690 IF T<0 THEN T=0
3700 IF U<0 THEN U=0
3710 GOTO 3910
3720 PLAY Q$(6):PLAY Q$
3730 Q$(6)="T2"
3740 CLS:PRINT@232," PRESS ANY K
EY";
3750 PRINT@2,T$(2);T;"     ";U$(2)
;U;
3760 T$= INKEY$: IF T$="" THEN 3
760
3770 CLS: RETURN
3780 B$="":M$="":VV=0:N=LEN(Q$(1
))
3790 CLS:PRINT@230,"ONE MOMENT P
LEASE"
3800 VV=VV+1
3810 IF VV=>N+1 THEN Q$(1)=M$:RE
TURN
3820 PRINT@2,T$(2);T;"     ";U$(2
);U;
3830 T$=LEFT$(Q$(1),VV)
3840 Z$=MID$(T$,VV)
3850 Z$=MID$(Z$,1)
3860 IF VV=>N+1 THEN 3880
3870 QQ=ASC(Z$)
3880 IF QQ=64 THEN Z$=CHR$(32):B
$=Z$:M$=M$+B$:GOTO 3800
3890 Z$=CHR$(QQ-1):M$=M$+Z$:GOTO
 3800
3900 GOTO 3800
3910 PMODE 3,1
3920 PCLS
3930 SCREEN 1,0
3940 DRAW"S5;C0;BM14,72"+WW$
3950 AA$="S5;C0;BM+8,0"
3960 DRAW AA$+RR$
3970 DRAW AA$+OO$
3980 DRAW AA$+NN$
3990 DRAW AA$+GG$
4000 B=50
4010 PAINT(B,80),2,0
4020 B=B+28
4030 IF B=106 THEN 4020
4040 IF B=>208 THEN 4070
4050 IF B=>190 THEN LET B=208:GO
TO 4010
4060 GOTO 4010
4070 B=16
4080 PAINT(B,84),0,0
4090 IF B>177 THEN 4160
4100 IF B=211 THEN LET B=210:GOT
04080
4110 IF B=177 THEN LET B=196:GOT
O 4080
4120 IF B=152 THEN LET B=177:GOT
O 4080
4130 IF B=107 THEN LET B=137:GOT
04080
4140 IF B=61 THEN LET B=92:GOTO
4080
4150 B=B+15:GOTO 4080
4160 PAINT(210,86),0,0
4170 PAINT(82,74),3,0
4180 B=132
4190 PAINT(B,74),3,0
4200 IF B>200 THEN 4220
4210 B=B+24:GOTO 4190
4220 PAINT(81,95),0,0
4230 PAINT(81,85),3,0
4240 PAINT(122,95),3,0
4250 PAINT(222,84),3,0
4260 PAINT(222,95),3,0
```



COMPANY COMMANDER

CINC PAC — Battle of Midway 32K

Ark Royal's masterpiece game of naval strategy of perhaps the most important battle in the history of the United States Navy. Hi Res graphics, 75% machine language allows player to control as many as 41 separate units on the screen at one time. Command Task Forces 16 & 17 as they play cat and mouse with the Japanese fleet. Maneuver the Hornet, Yorktown and Enterprise into the best position. Set courses and launch search and attack aircraft then hope for the best. Find the enemy fleet, then pick the targets: Akagi, Soryu, Kaga, Yamato and others in this historically accurate game. Relive history, Admiral, and it won't be any easier this time around. Anchors Aweigh.

Game save. Requires disk version to operate on disk. Cassette $27.95.

COMPANY COMMANDER 32K

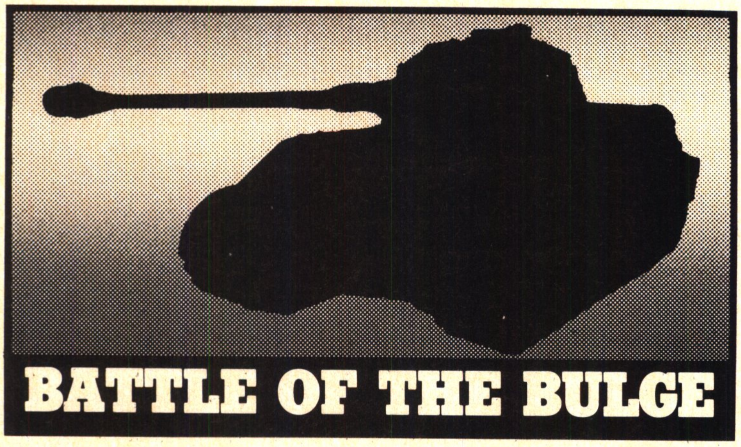
Game module 1 — **House to House.** Ark Royal's squad level WWII infantry combat game.

They said it couldn't be done — a SQUAD LEVEL wargame on a computer — but we've done it. The Line of Sight problem is licked — and the machine language routines really speed things up.

Game Module #1 comes with House to House map and 10+ scenerios involving infantry combat in Aachen, Caen, Arnheim, Stalingrad and other famous WWII city battlegrounds. Combat units include rifle squads, mortar teams, machine gun crews, engineers, and more (depending on the scenerio chosen), leaders, vehicles and other weaponry of WWII. Unique design allows incorporation of future expansion modules.

Choose campaign play and put yourself on the battlefield, Corporal Smith or Jones; collect points toward promotion. Order up smoke from the mortar squad, HE for those dug in units. Take the objective and you might make Major someday. Just don't step on a land mine.

Comes with House to House game map, more than 10 scenerios, on 2 cassettes, or all on 1 disk...$29.95. (Disk included.)



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Ark Royal's 1 or 2 player game by the author of Battle For Tunis, Bulge recreates operation **Wacht Am Rhein,** Hitler's last desperate gamble of WWII. In none of our games is the fog of war so apparent than in BULGE. You know the Germans have attacked in the Ardennes, but little else. What is their strength? Their objective? Who do you send to repair the huge gap in the American lines? What bridges do you blow? Can you protect the fuel depots? Where are all those Tigers coming from? When will the weather clear?

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* Denotes Rainbow review month

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```
4270 PAINT(28,95),3,0
4280 PAINT(44,95),3,0
4290 SS$="T1O2L8F#F#L8...AL8F#L4
F#AL8F#AO3L4DL8...C#O2L8BL4BA"
4300 PLAY SS$
4310 PLAY"T2"
4320 CLS:PRINT@235,"NEXT NOTE"
4330 FOR X=1 TO 550:NEXT X
4340 GOTO 3250
4350 PMODE 3,1
4360 PCLS
4370 SCREEN 1,0
4380 DRAW"S4;BM4,68;"+CC$
4390 BB$="BM+8,0;"
4400 DRAW BB$+OO$
4410 DRAW BB$+RR$
4420 DRAW BB$+RR$
4430 DRAW BB$+EE$
4440 DRAW BB$+CC$
4450 DRAW BB$+TT$
4460 YY=0:X=0:BB=36
4470 GOSUB 4520
4480 PAINT (B,C),X(1),0
4490 X=X+1:B=B+BB
4500 IF X=XX THEN YY=YY+1:X=0:ON
 YY GOTO 4530,4540,4550,4560,457
0,4580,4590,4600,4610
4510 GOTO 4480
4520 B=20:C=70:XX=7:X(1)=3:RETUR
N
4530 B=6:C=71:X(1)=0:GOTO 4480
4540 B=20:C=74:X(1)=2:GOTO 4480
4550 B=66:XX=3:C=78:X(1)=0:GOTO
4480
4560 B=92:X(1)=3:GOTO 4480
4570 B=164:XX=2:C=86:GOTO 4480
4580 B=24:GOTO 4480
4590 B=94:X(1)=0:GOTO 4480
4600 XX=1:B=234:GOTO 4480
4610 GOTO 3720
4620 PRINT
4630 PRINT@230,"ONE MOMENT PLEAS
E";
4640 B$="":M$="":VV=0:M=LEN(Q$(8
))
4650 VV=VV+1
4660 IF VV=>M+1 THEN Q$(8)=M$:GO
TO 4710
4670 T$=LEFT$(Q$(8),VV):Z$=MID$(
T$,VV):Z$=MID$(Z$,1)
4680 QQ=ASC(Z$)
4690 IF QQ=64 THEN Z$=CHR$(32):B
$=Z$:M$=M$+B$:GOTO 4650
4700 Z$=CHR$(QQ-1):M$=M$+Z$:GOTO
 4650
4710 CLS:PRINT@200,"T I M E   U
P"
4720 PRINT@297,"THE TUNE IS"
4730 PRINT
4740 PRINTQ$(8)
4750 PLAY Q$
4760 CLS
4770 T$=INKEY$
4780 PRINT@227,"PRESS ENTER FOR
NEXT SONG"
4790 IF T$=CHR$(13) THEN RETURN
4800 GOTO 4770
4810 CLS
4820 PRINT@72,"GAME FINISHED"
4830 PRINT@136,"final score"
4840 PRINT@200,T$(2);" ";T
4850 PRINT@232,U$(2);" ";U
4860 C$="CONGRADULATIONS"
4870 FOR X=1 TO 3000:NEXT X
4880 IF U>T THEN 4920
4890 IF T>U THEN 4950
4900 CLS:PRINT@236,"TIE GAME"
4910 GOTO 4970
4920 CLS:PRINT@228,C$;" ";U$(2)
4930 PRINT@300,"YOU WIN"
4940 GOTO 4970
4950 CLS:PRINT@228,C$;" ";T$(2)
4960 PRINT@300,"YOU WIN"
4970 PLAY Q$
4980 T$=INKEY$
4990 PRINT@418,"WANT TO PLAY AGA
IN (Y)/(N)?"
5000 IF T$="Y" THEN 20
5010 IF T$="N" THEN CLS:END
5020 GOTO 4980
```

One-Liner Contest Winner . . .

Little Brown Jug draws the object and plays the song. Need we say more?

The listing:

```
10 PCLS:PMODE3,1:SCREEN1,1:DRAW"
BM110,50;S8R9D2NL9G1D9F10D28L27U
28E10U9H1U3":PAINT(115,60),3,0:A
$="O3L8EGL4GL8FAL4AL10BBL8BAB":P
LAY"L4O3DL8O2BO3DDDCEP35E;L10EEF
#;F#;L8F#EF#GO3AL4BL8O2BO3DDDCEL
4E;L8F#F#EF#O3AGL4G;XA$;O4CDL4E;
XA$;O4DL4CC"
```

C. MacKenzie
Tofield, Alberta

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape*.)

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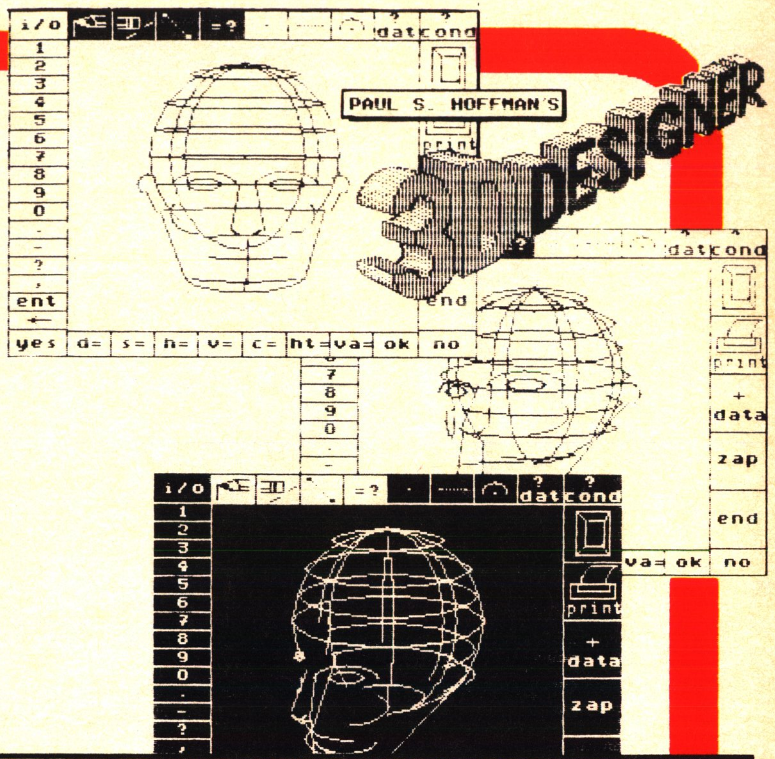

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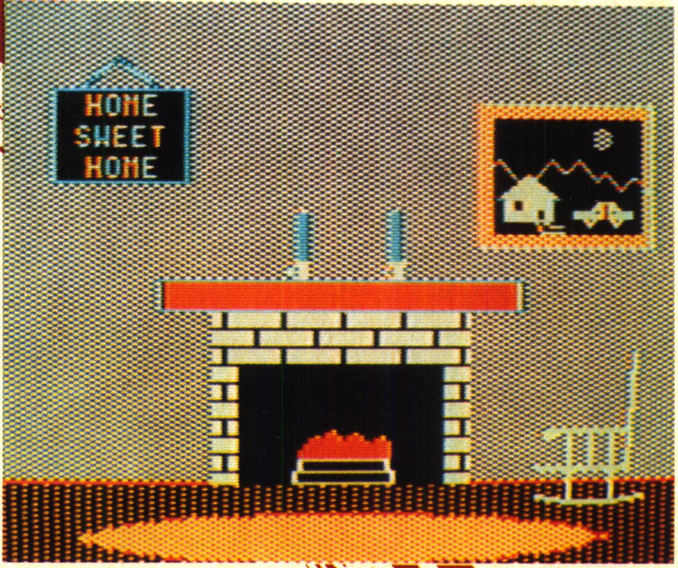
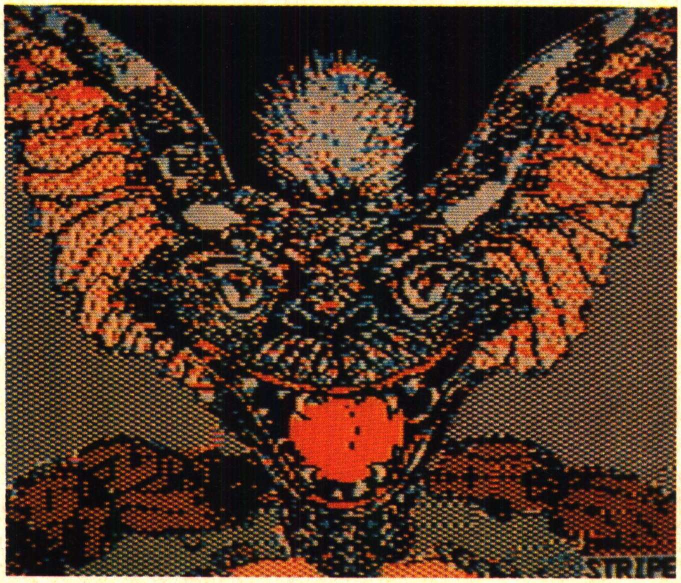


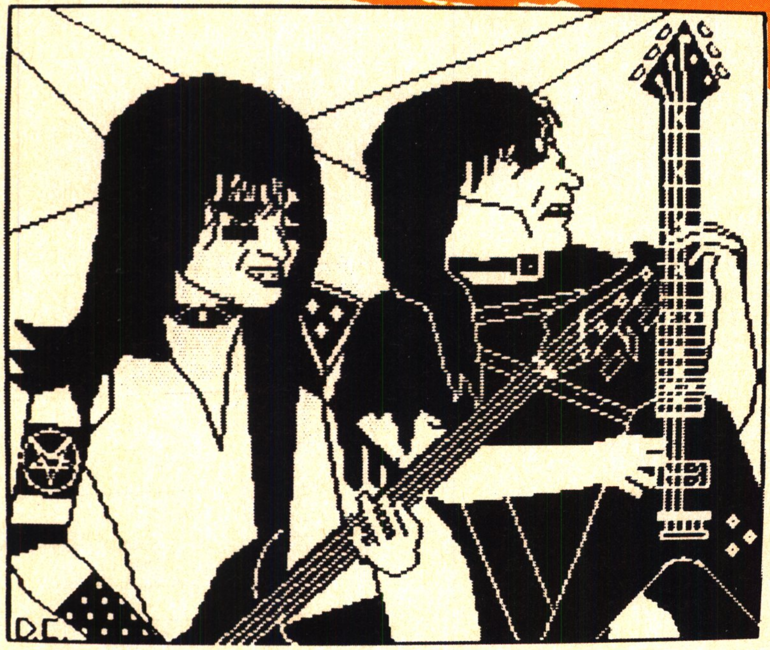
HONORABLE MENTION

Glenn Thibert
Picture
Glenn used BASIC with techniques found in the January 1985 issue of RAINBOW's "Wishing Well" by Fred Scerbo.

1st PLACE



Ana Landa Hutchison
Gremlin
Ana drew this portrait of "Stripe" using *Graphicom*.

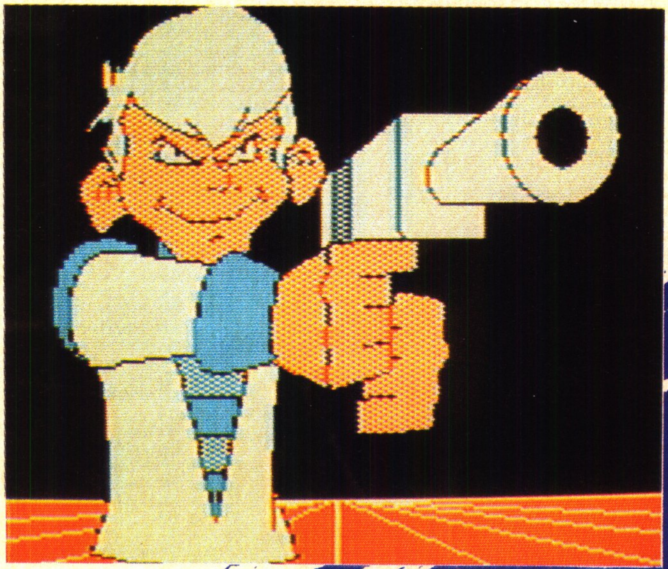


3rd PLACE

David Casuscelli
Crue
David drew this using BASIC's DRAW and LINE commands. He is a freshman at Drury Senior High School in North Adams, Mass.

Greg Juby
Spaceface
Greg drew this in BASIC using DRAW commands and has been programming on his CoCo for three years.

2nd PLACE



Send your entry on either tape or disk to:

CoCo Gallery
THE RAINBOW
P.O. Box 385
Prospect, KY 40059
Attn: Monica Dorth

Be sure to send a cover letter with your name, address and phone number detailing how you created your picture (what programs you used, etc.), how to display it and a few facts about yourself.

Please don't send us anything owned by someone else; this means no game screens, digitized images from TV programs or material that's already been submitted elsewhere.

We will award a first prize of $25, a second prize of $15 and a third prize of $10. Honorable mentions also will be given.

RAINBOW

Give us your best: Join the ranks of these courageous CoCoists in showing the Color Computer world your high score at your favorite micro-diversion. We want to put your best effort on record in THE RAINBOW's Scoreboard column. All entries must be received 60 days prior to publication. Entries should be printed — legibly — and must include your *full* name, address, game title, company name and, of course, your high score. Each individual is limited to three score entries per month. Send your entries to Scoreboard, c/o THE RAINBOW.

★ Current Record Holder

ANDRONE *(Radio Shack)*

61,660	★John Beeler, Columbia, MD
60,710	Philippe Vallee, St. Raymond, Quebec
57,410	Daphnie Phillips, Evansville, WI
41,355	Ryan Devlin, Louisville, KY
40,030	Matthew W. Swadling, North Vancouver, British Columbia

ASTRO BLAST *(Mark Data)*

20,575	★Tom Neal, Wabash, IN
15,600	Joseph Dehn, Tucson, AZ

BASEBALL *(Radio Shack)*

1,409-0	★Brad Widdup, Dundas, Ontario
740-0	Daniel Belisle, Montreal, Quebec
543-0	Kevin Cornell, Greentown, IN
464-0	Dave Fisher, St. Downey, CA
460-0	Walter Trainlips, Janesville, WI

BATS AND BUGS (THE RAINBOW)

24,600	★Michael Rosenberg, Prestonburg, KY
8,450	Bill Martin, Myrtle Beach, SC
7,200	Lezlee Bishop, Salt Lake City, UT
5,220	Brian Cook, Dixon, IL
3,600	Apollo Latham, Rich Square, NC

BIRDS *(Tom Mix)*

147,200	★Scott Burns, Columbia, SC
103,925	Luc Soucy, Baker-Brook, New Brunswick

BLACKBEARD'S ISLAND *(Tom Mix)*

84	★Chris Cope, Central, SC
86	Mikel Rice, Panama City, FL

BLACKJACK *(Radio Shack)*

12,501	★Steven Allen, Sharpsburg, MD

BLACK SANCTUM *(Mark Data)*

485	★Phil & Alison Billoni, Lancaster, PA

BLOC HEAD *(Computerware)*

41,975	★Michael Hebb, Victoria, Australia
23,500	Paschal Wilson, Kentwood, LA

BUSTOUT *(Radio Shack)*

42,895	★Steven Roth, Fannystelle, Manitoba
14,756	Amir Ijaz, Winnipeg, Manitoba
13,000	Ken Dewitt, Blue Island, IL

CANYON CLIMBER *(Radio Shack)*

162,500	★Michael Sileo Jr., Glendale, NY

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1,245	★Sean Conner, Summit, NJ
1,213	Doug Schwartz, Glendale, AZ
968	Michael Mefferd, Wren, OH
963	Joseph Calcaterra, Ridgewood, NY
790	John Rivers, North Adams, MA

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69,100	★Blossom Mayor, East Greenbush, NY

CHAMELEON *(Computerware)*

55,800	★Brian Wolfgram, Freeland, MI

CHOPPER STRIKE *(MichTron)*

262,900	★Dan Hopper, Omaha, NE
194,800	Andrew Norrie, Mississauga, Ontario
167,600	Michael Hebb, Victoria, Australia
162,400	Andrew Figel, Sardis, OH
130,200	Benny Pischke, Lloydminster, Saskatchewan

CHUCKIE EGG *(A&F)*

391,670	★Paul Hotz, Herzlia, Israel
255,140	Laura Hotz, Herzlia, Israel

CLIMB *(Chromasette)*

20,050	★Neil Haupt, Grafton, OH

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125,010	★Karen Tracy, Coventry, RI

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668-0	★Christian Roch, Granby, Quebec
254-0	Chris Reynolds, Richmond, KY
250-0	Rob Mowery, Robinson, PA
158-0	Bart Ankrom, Atlanta, KS
135-0	Chuck Carroll, Suisun City, CA
70-0	Jeffery Chubey, Roseau River, Manitoba
93-1	Craig Dunne, Windsor, Ontario
92-1	Jonathon Baker, Harmony, NC
76-3	Rhett Bagnall, Saskatoon, Saskatchewan

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200,250	★Richard Fiore, Clemson, SC

COLOR CAR *(NOVASOFT)*

154,600	★Scott Cunningham, East Lyme, CT
130,483	Dan Bouges, Niantic, CT

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10,001,051	★Mark Smith, Santa Ana, CA
5,756,808	Scott Oberholtzer, Lexington, MA
3,355,248	Scott Drake, Pine City, NY
2,614,230	Jerry Petkash, Warren, MI
2,547,299	Rich McGervey, Morgantown, WV

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19,850	★Darren Talbot, Hawkesbury, Nova Scotia

CRASH *(Tom Mix)*

13,300	★David Craft, Roanoke, VA

CRUISING *(Sunshine)*

3,062	★Laura Hotz, Herzlia, Israel

DALLAS QUEST *(Radio Shack)*

91	★Maggie Budewitz, St. Paul, MN
99	John Allocca, Yonkers, NY
125	Herbert Patterson, Largo, Fl

DEMOLITION DERBY *(Radio Shack)*

106,400	★David Oelhaupl, Calgary, Alberta
79,100	David Close, Springfield, VA
44,000	Joseph Dehn, Tucson, AZ
32,900	Les Dorn, Eau Claire, WI

DEMON II (THE RAINBOW)

12,475	★Rhett Bagnall, Saskatoon, Saskatchewan
10,075	Frank Canepa III, Santurce, Puerto Rico
1,800	Bryan Ecker, Lusby, MD

DEVIL ASSAULT *(Tom Mix)*

4,773,140	★Husker Le Gault, Argyle, NY

DOODLEBUG *(Computerware)*

825,370	★Susan Ballinger, Uxbridge, Ontario

DOUBLE BACK *(Radio Shack)*

235,110	★Les Dorn, Eau Claire, WI
211,790	Rachel Soldan, Gresham, OR
43,100	Laurence Zafran, New York, NY
19,850	Luc Soucy, Baker-Brook, New Brunswick

DOWNLAND *(Radio Shack)*

20,900,400	★Adam Petersen, Portland, OR
68,345	Alain Cyr, Valcourt, Quebec
66,145	Jeanine McCuen, Rutland, MA
47,632	Laurence Zafran, New York, NY
46,031	Shannon Blakey, Columbia, MO
44,143	Tom Audas, Fremont, CA
40,712	Thomas Audas II, Fremont, CA
17,580	Amos Goldie

DRACONIAN *(Tom Mix)*

480,540	★Lane Dewhirst, Courtenay, British Columbia

ELEC*TRON *(Tom Mix)*

35,225	★Vernon Johnson, Parkville, MD
24,715	Daniel Bee, Flint, MI

FANGMAN *(Tom Mix)*

155,225	★Daniel Thompson, St. Louis, MO

FOODWAR *(Arcade Animation)*

151,070	★Mathieu Paquin, Brossard, Quebec
147,645	Matt Griffiths, Stilwell, KS
116,000	Chris Cope, Central, SC
104,075	Mike Scharf, Fremont, OH
94,905	Stephane Asselin, Baie-Comeau, Quebec

FOOTBALL *(Radio Shack)*

78-0	★Steven Allen, Sharpsburg, MD

THE FROG *(Tom Mix)*

6,890	★Mike Dodge, Jackson, MI

FROGGER *(Cornsoft)*

12,000	★Nicole Freedman, Wellesley, MA

FROGGIE *(Spectral Associates)*

112,120	★David Oelhaupl, Calgary, Alberta
108,490	Bill Ide, Newark, DE

FURY *(MichTron)*

406,700	★Russell Lapeze, New Orleans, LA
191,280	Mario Pelletier, Ste-Foy, Quebec
132,200	Dennis Martin, Chalmette, LA
113,700	Bernd Pruetting, Scheibenhardt, West Germany
107,760	Chris Detje, Danbury, CT

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135,180	★Mario Asselin, Baie-Comeau, Quebec
75,830	Tom Neal, Wabash, IN

GRABBER *(Tom Mix)*

149,350	★Craig Webster, Argyle, NY
142,300	Paul MacArthur, Gillett, WI
130,450	Daniel Belisle, Montreal, Quebec
109,100	Stephen Zamonski, Ewing, NJ

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3,336	★Paschal Wilson, Kentwood, LA
2,810	Jocko Valentino, Timonium, MD

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1,605	★Mike Dodge, Jackson, MI

HEIST (THE RAINBOW)

2,100	★Chris Reynolds, Richmond, KY
2,100	★Sergio Waisser, Mexico City, Mexico
1,500	Susan Ballinger, Uxbridge, Ontario
1,500	Julio Comello, Scarborough, Ontario
1,500	Kirstie Compton, Suffield, CT
1,500	Gary Creaser, Argyle, NY
1,500	Andy Dater, Medford, OR
1,500	David Figel, Sardis, OH
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1,500	Jeff Roberg, Winfield, KS
1,500	Brendan Smith, Coral Springs, FL
1,500	Kevin Speight, Bridgewater, Nova Scotia
1,500	Rupert Young, Sheffield, MA

THE INTERPLANETARY FRUIT FLY (THE RAINBOW)

37,000	★Scott Perkins, Port Orange, FL
27,500	Les Dorn, Eau Claire, WI
26,000	Eric Foss, Cochrane, Alberta
25,500	Michele Gaboriault, Foxboro, MA
25,000	Andrew Bartels, Sulphur, OK
20,000	Joe Calcaterra, Ridgewood, NY
17,000	Susan Ballinger, Uxbridge, Ontario
12,500	Michael Sileo Jr., Glendale, NY
10,000	Kirk Carter, Cooper City, FL

THE JUNGLE (THE RAINBOW)

668,690,000	★Jeff Lawrence, Cambridge, Ontario
459,351,041	Denise Morin, Hudson, MA
4,560,144	Jon Hobson, Plainfield, WI
4,134,000	Brandon Duncan, Benton, KS
29,452	Scott Bellman, Davenport, IA

JUNIOR'S REVENGE *(Computerware)*

8,020,000	★Ian Stewart, Lynwood, Perth-Australia
786,300	Richard Wiseman, Marion, OH
36,200	Stephane Asselin, Baie-Comeau, Quebec

JUNKFOOD (THE RAINBOW)

1,079,600	★Jean-Francois Morin, Loretteville, Quebec
357,940	Larry Thomson, Menominee, MI
309,460	Shirley Black, Quinton, AL
206,940	Rhett Bagnall, Saskatoon, Saskatchewan
198,200	Sheila Bigel, Massapequa, NY
72,640	Michael Chamberlin, Dawson Creek, British Columbia
40,750	Vernon Johnson, Parkville, MD

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29,052	★Tony Boring, Armagh, PA

THE KING *(Tom Mix)*

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1,003,400	Tim Rueb, Atlanta, GA
337,800	Kirk Carter, Cooper City, FL
300,000	Larry Cowles, Westport, WA
241,200	Chris McKernan, Chateauguay, Quebec
78,600	Craig Crowe, Summerville, SC

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927,727	Doug Franzen, Westlake, OH
902,516	Les Dorn, Eau Claire, WI
728,076	L. Grant Shideler, Lakewood, CO
312,980	Alfred Silva, Cranston, RI
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152,250	Ryan Morrison, South Lyon, MI
144,000	Robbie McDaniel, Rutherfordton, NC
138,500	Ted Barkley, Whitehall, NY
117,150	Bill Strey, Tucson, AZ
111,950	Hans Brinkmann, Burlington, Ontario
56,900	Jeff Reyer, Apollo, PA
55,800	Kirk Carter, Cooper City, FL
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13,834	★Dean McWhorter, Argyle, NY
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179,350	Thomas Green, Natchez, MS
170,900	Jeremy Moon, Christchurch, New Zealand
79,950	Paul Hotz, Herzlia, Israel
76,960	Mike Rebbecchi, Somerdale, NJ
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MAZELAND *(Chromasette)*	
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178,550	Apollo Latham, Rich Square, NC
144,350	Theodore Latham Jr., Rich Square, NC
98,450	Kent Jakway, Garrett, IN
77,300	David Barnekow, Elkhorn, WI
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2-1	★Joe Calcaterra, Ridgewood, NY
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205,180	★Richard Fiore, Clemson, SC
200,020	Terry Steele, Summerfield, NC
200,000	Jason Pelfrey, Germantown, TN
115,130	Theodore Latham Jr., Rich Square, NC
32,470	Brett Ankrom, Atlanta, KS
MR. DIG *(Computerware)*	
3,259,750	★Ellen Ballinger, Uxbridge, Ontario
3,100,650	Biagio Di Lorenzo, Montreal, Quebec
3,001,100	Ross & Daniel Mehlman, Todd Boehm, Nashville, TN
2,875,870	Ann-Marie MacKay, Port Hardy, British Columbia
2,520,650	Thomas Henry, Boca Raton, FL
2,038,250	Mario Asselin, Baie-Comeau, Quebec
MUDPIES *(MichTron)*	
285,600	★Stephen Zamonski, Ewing, NJ
249,800	Brian Wolfgram, Freeland, MI
137,000	David Craft, Roanoke, VA
114,800	Barry Stanton, North East, PA
NINJA WARRIOR *(Programmer's Guild)*	
421,900	★Chris Reynolds, Richmond, KY
OFFENDER *(American Business Computers)*	
289,300	★Christine Leonard, Minona, NY
127,500	B.J. McDonald, Mint Hill, NC
OUTHOUSE *(MichTron)*	
7,001	★Luc Soucy, Baker-Brook, New Brunswick
PENGUIN (THE RAINBOW)	
48,250	★Paul Wagorn, Carp, Ontario
13,920	Michael Chamberlin, Dawson Creek, British Columbia
11,660	David Bartmess, Fayetteville, PA
11,620	Michael Sileo Jr., Glendale, NY
10,790	Nick Kessel, Appleton, WI
10,320	Joe Calcaterra, Ridgewood, NY
PHANTOM SLAYER *(Med Systems)*	
1,326	★Susan Ballinger, Uxbridge, Ontario
PINBALL *(Radio Shack)*	
200,712	★Thomas Audas II, Fremont, CA
PIPELINE (THE RAINBOW)	
1,332	★Kent Prehn, Carol Stream, IL
1,162	Mike Garozzo, Morrisville, PA
925	Andy Green, Whitehall, PA
483	Susan Ballinger, Uxbridge, Ontario
405	Joe Bironas, Crestwood, KY
PLANET INVASION *(Spectral Associates)*	
59,600	★Terry Steele, Summerfield, NC
32,350	Susan Ballinger, Uxbridge, Ontario
10,750	Saul Kirsch, Ra'anana, Israel
8,950	Michael Derman, Tel-Aviv, Israel
POLARIS *(Radio Shack)*	
171,862	★Thomas Levasseur, Rockland, ME
133,726	Ed Meyer, Vancouver, British Columbia
112,535	Brett Ankrom, Atlanta, KS
87,910	Ron Sujkowski, Bay City, MI
62,586	Bart Ankrom, Atlanta, KS
POLTERGEIST *(Radio Shack)*	
4,885	★Frank Canepa III, Santurce, Puerto Rico
4,830	Lisa Ballinger, Uxbridge, Ontario
4,200	Bryan Ecker, Lusby, MD
3,740	Tina Hurst, Lake City, FL
POOYAN *(Datasoft)*	
1,546,000	★Jeff Connell, Winona, MN
1,250,350	Richard Hawkins, Cleveland, TN
900,250	Daniel Belisle, Montreal, Quebec
194,800	Helene Gilbert, Rouyn-Noranda, Quebec
106,100	Tom Neal, Wabash, IN
97,900	Ellen Ballinger, Uxbridge, Ontario
80,100	Steven Nudelman, Brooklyn, NY
79,000	Jamie Carlson, Glencoe, MN
71,900	Laura Hotz, Herzlia, Israel
POPCORN *(Radio Shack)*	
45,210	★Mike Norris, Columbia, SC
41,910	Nicole Freedman, Wellesley, MA
36,500	Barry Stanton, North East, PA
30,180	Craig Gordon, Philadelphia, PA
28,810	Steven Roth, Fannystelle, Manitoba
24,810	Mark Carpentier, Dunfermline, IL
21,130	Abby Gordon, Philadelphia, PA
PROJECT NEBULA *(Radio Shack)*	
2,010	★Dan Heater, Cortland, OH
1,705	Ken Krejca, Chicago, IL
1,540	Tim Rueb, Atlanta, GA
535	Joseph Dehn, Tucson, AZ
485	Jeff Kilsdonk, Milwaukee, WI
Q-NERD (THE RAINBOW)	
1,958,950	★Bruce Baltzer, Hanover, Ontario
61,290	Sean Conner, Summit, NJ
QUEST *(Aardvark)*	
5,720,875	★Mike Cook, Phoenix, AZ
QUIX *(Tom Mix)*	
907,320	★Andrew Norrie, Mississauga, Ontario
323,373	Jean-Francois Lauzier, Asbestos, Quebec
271,965	Nicole Freedman, Wellesley, MA
187,553	Stephane Asselin, Baie-Comeau, Quebec
RAAKA-TU *(Radio Shack)*	
50	★Ellen Ballinger, Uxbridge, Ontario
50	★Faith Barnett, Syracuse, NY
50	★Scott Bellman, Davenport, IA
50	★Jeff Brock, Ft. Lauderdale, FL
50	★Mike Bubb, Grafton, OH
50	★Mike Camden, Follansbee, WV
50	★Brett Casteel, Russell, PA
50	★Chris Chamberlin, Dawson Creek, British Columbia
50	★Chris Cope, Central, SC
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RACER (THE RAINBOW)	
159.9	★Frank Canepa III, Santurce, Puerto Rico
90.2	Chris Neal, Wabash, IN
RADIO BALL *(Radio Shack)*	
4,510,740	★Les Dorn, Eau Claire, WI
3,708,810	Stephen Zamonski, Ewing, NJ
1,738,150	Mickey Emberton, Indianapolis, IN
1,511,640	Kelly Dion, Cap-de-la-Madeleine, Quebec
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RETURN OF THE JET-I *(ThunderVision)*	
538,432	★Matt Griffiths, Stilwell, KS
429,160	Jean-Francois Bruneau, St-Hubert Quebec
ROAD RACE (THE RAINBOW)	
91.7	★Bill Martin, Myrtle Beach, SC
576.6	Eric Clarkson, Missouri City, TX
706.1	Michael Hebb, Victoria, Australia
1212.4	Michael Martens, Wausau, WI
2158.5	Steven Roth, Fannystelle, Manitoba
ROBOTTACK *(Intracolor)*	
7,528,100	★Mike Scharf, Fremont, OH
4,646,489	Cory Soper & Edwin Prather, Oxnard, CA
3,364,100	Wade & Troy Woods, Paul MacLennen, Tiverton, Ontario
2,516,050	Horace Hamilton, Calgary, Alberta
2,216,950	Randy Hankins, Tabor, IA
SAILOR MAN *(Tom Mix)*	
535,900	★Scott Sherman, Woodstown, NJ
488,600	Paul Kenyon, Phoenix, AZ
435,700	Andy Dater, Medford, OR
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399,300	Jeff Picketts, Brantford, Ontario
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188,500	Brian Roberson, Collinsville, IL
SANDS OF EGYPT *(Radio Shack)*	
80	★John Allocca, Yonkers, NY
82	Jeff McKay, Travis AFB, CA
98	Aaron Durkee, Lansing, MI
198	Bob Mazzola, Freehold, NJ
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146	★N. Wakelin, Mt. Lebanon, PA
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399,400	★Adam Petersen, Portland, OR
46,960	Patrick Scott, Whitehall, NY
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01.10	Mike Scharf, Fremont, OH
01:12	Sean Conner, Summit, NJ
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84,714	★Thomas Audas II, Fremont, CA
74,078	Tom Audas, Fremont, CA
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24,681	Bobby Cha, Fullerton, CA
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1:24	★Luanne Ashby, Phoenix, AZ
1:26	Dan Sobczak, Mesa, AZ
1:37	Susan Ballinger, Uxbridge, Ontario
1:50	Andy Green, Whitehall, PA
1:59	Baiju Shah, Deep River, Ontario
SPACE AMBUSH *(Computerware)*	
24,150	★Mario Asselin, Baie-Comeau, Quebec

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— Debbie Hartley

SCOREBOARD POINTERS

In conjunction with THE RAINBOW's Scoreboard, we offer this column of pointers for our game-playing readers' benefit. If you have some interesting hints and tips, we encourage you to share them by sending them to the Scoreboard, c/o THE RAINBOW.

TAKING A POLE

Scoreboard:

In response to Lane Shelton's letter [April 1985, Page 160] concerning *Shenanigans*, in order to get the pole into the cave you must first find the trap door in the ceiling of the lower level of the cave. You will rise through the floor of the cabin, then get the pole and take it down with you.

One last thing — ever heard of sliding down a Rainbow? In this game, it's fatal.

If anyone can help me once I'm on the mystery-coordinate planet in *Trekboer*, I'd appreciate it. My address is 141 Lovers Lane, 43952.

George Caleodis
Steubenville, OH

SOLUTIONS FOR HIRE

Scoreboard:

Attention Adventurers! Many of you have read Ryan Elam's letter in the November 1984 issue of THE RAINBOW and have written for solutions. Well, for those of you who are interested, Ryan Elam has moved and can no longer continue to offer solutions. Instead, I am making the same type of offer, but with a few more Adventures.

I have several Adventures solved and available for $1 per solution. They are encoded and come with a decoder program and instructions. These solutions are available: *Blackbeard's Island, Black Sanctum, Calixto Island, Dallas Quest, Major Istar, Mystic Mansion, Sands of Egypt, Sea Quest, Shenanigans, Trekboer, Bedlam, Pyramid* and *Raaka-Tu*.

Please include one stamp for return postage or two stamps if ordering three or more solutions. Write to 539 S. Berthe Ave., 32404.

Mikel Rice
Panama City, FL

TIPS FOR TREKBOER

Scoreboard:

I solved the Adventure game *Trekboer* and found the most difficult part of the game to be past the bridge on Alton.

Once you have found the amulet and have the capsule and a beaker full of acid, you are ready to cross the bridge. Once past it, type `GO FIELD`. Be sure, however, that you have tied the rope to the tree east of the bridge before crossing.

For additional tips on *Trekboer* write to me at 939 S. Harriet, 46151. Please include a SASE.

Jim Cockrum
Martinsville, IN

BOARD WITH BUGS?

Scoreboard:

For Radio Shack's *Klendathu*, my brother and I would like to give bug-killers these tips.

If you're looking for Queen's Boards, stay in the corners of the grid. Also, when you push the space bar to start your jump, if the board immediately under your trooper says "bug," then wait. The square you are on will light up as a Queen's Board. Finally, if you wait for time to run out while you are on the scoreboard, you will make a tremendous amount of money. I have made as much as $340,000,000.

We need help with *Pyramid, Raaka-Tu* and *Madness and the Minotaur*. Anyone with information please write to me at 1010 Montclair Circle, 44145.

Dan Franzen
Westlake, OH

SPELL IT

Scoreboard:

In *Madness and the Minotaur*, if your lamp runs out of oil, find the urn and type `FILL LAMP`. This will solve your problem. When you are in the room with the Narcissus plants, type `OPEN CURTAINS`. Sometimes they will open, sometimes not. When they do, you'll find there's a passage you can "jump" into. Whenever you start a new game, go upstairs immediately. Sometimes you will find the dagger there and sometimes food. If you have food, no more will appear until you eat what you have.

How do you know when you have gotten a spell and how do you use it?

I have solved *Calixto Island* and *Bedlam*. I need help with *Madness and the Minotaur*, *Pyramid, Raaka-Tu* and *Black Sanctum*. If anybody can help me with these or if anyone needs help with *Bedlam, Calixto Island* or other neat things in *Madness and the Minotaur*, write to me at 474 Montague Ave., R3L 1T7.

Ric Miller
Winnipeg, Manitoba

FADING AWAY

Scoreboard:

Yes, the Minotaur is driving me to madness. I must know before it is too late: Where is the lamp oil? Why are the walls a strange color? And what is the eerie glow from behind the rocks? I'm slipping away fast. Please help! Send the answers, or the name of a good institution, to 1137-A Pebble Creek Pkwy., 35208.

Doug Miles
Birmingham, AL

Scoreboard:

I have a suggestion to anyone who writes a letter to be printed in the "Scoreboard" section of THE RAINBOW. If you expect to have a written response to your letter from other readers, please include your street address (and ZIP code) in your letter. It is quite difficult to respond to a letter without all of the necessary information.

Randolph L. Harrison
Wilmington, OH

SHARK REPELLENT

Scoreboard:

To get past the sharks in *Sea Quest*, get the metal detector, go to the bottom of the stairs and go east once. `PUSH BUTTON`, `DIG` and `GET MIRROR`. Give the mirror to the mermaid to get a key to the trap door in the beach house. In the attic (through the trap door) you will find a bottle. Go to the sharks and `OPEN BOTTLE` and the sharks will leave.

If you would like the solutions to either *Sea Quest* or *Sands of Egypt*, or if you have a few questions about them, send a SASE to 30994, Bedford Dr., 92373.

This week I finally purchased *Pyramid*. From reading all the letters in this section, I was expecting a lot. I didn't even think about the fact that there might not be graphics. I expected there would be. I still think it's a great Adventure, but without graphics it is not quite as good. What I would like to know is do the other Radio Shack Adventures (*Bedlam, Raaka-Tu* and *Madness and the Minotaur*) have graphics? If anyone writes to me concerning the above Adventures, please tell me (if you know) whether or not *any* of the Radio Shack Adventures have graphics.

Brett Noble
Redlands, CA

Scoreboard:

I am in a position to offer comprehensible, step-by-step help sheets on the following: *Black Sanctum, Calixto Island, Trekboer* and *Sands of Egypt*. They are printouts of all the necessary inputs to get you through the game.

I also might be able to help with these: *Alpha II, Bedlam, Head of the Beast, Karrak, Lurkley Manor* and *Raaka-Tu*. And I've had many good landings with *Worlds of Flight* and *Flight Simulator* and may have some tips.

If you feel I can help, please send a SASE to me and I'll be happy to respond to your request. My address is 11403 48th Dr., N.E., 98270.

James K. Knight
Marysville, WA

Scoreboard:

I have solved the games *Head of the Beast* and *Lurkley Manor*. I have the maps for both of these and if anyone needs help, please write. My address is 146 Woodward Ave., P.O. Box 1312, P0R 1B0.

Martin Steinke
Blind River, Ontario

Scoreboard:

I have solved *Sands of Egypt*. If anyone needs help, call (813) 251-6117 after 5 p.m., or send a SASE to me at 2801 Sitios Ave., 33629. I need help or clues for *Sea Quest, Trekboer, Shenanigans* and *Calixto Island*.

William Triplett
Tampa, FL

LET THERE BE LIGHT

Scoreboard:

Does anyone know how to open the crypt in *Madness and the Minotaur*, or how to light the lantern in *Black Sanctum*?

If anyone needs help with *Pyramid, Raaka-Tu, Dungeons of Daggorath, Bedlam* or *Calixto Island*, feel free to write to me at 1605 Fleetwood Ct., 62549.

Robbie Sablotny
Mt. Zion, IL

SLITHERING PAST THE SERPENT

Scoreboard:

I have had the Adventure game *Pyramid 2000* for about a year. I have never been able to get by the serpent in the pharaoh's chamber. Could someone please write to me and tell me how? My address is 11351 St. Laurent Dr., S9A 3P6.

Erik Nickel
North Battleford, Saskatchewan

NEEDY NEOPHYTE

Scoreboard:

Help! I am a reader in need. I need help with *Pyramid*. You see, I am new at all text Adventures and I mainly need help with the snake and the maze. I heard that a bird will kill the snake. Is this true? I have found the vase, but what do you do with it; you can't set it down. If anyone can help me, please send me the answers or clues at 6212 Glenhaven Dr., 79762. Help, please!

Nathan Sykes
Odessa, TX

CAVE CANEM

Scoreboard:

In the game *Bedlam*, I can't get past the dog in the kennel. It's driving me crazy! Do any of your readers have an idea that would help me?

Also, in the game *Black Sanctum*, how do you sprinkle the ash into the circle at the end of the game? My brother and I spent days getting to the end, only to find we can't "sprinkle" the ash. We dropped it and were killed instantly. If you have a solution send it to 1441 Kearney Drive, 08902. Please help us!

Judd Rossman
North Brunswick, NJ

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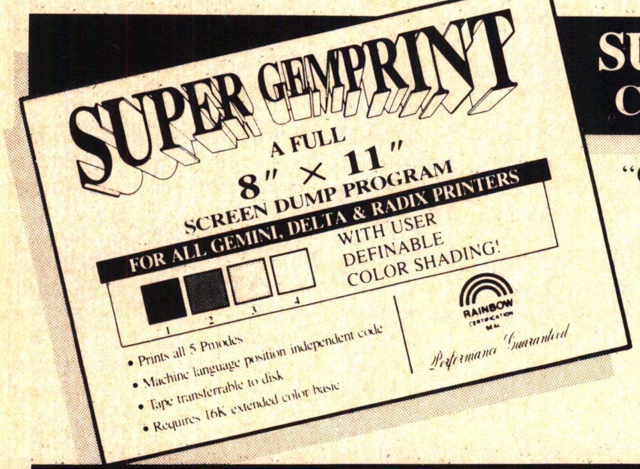

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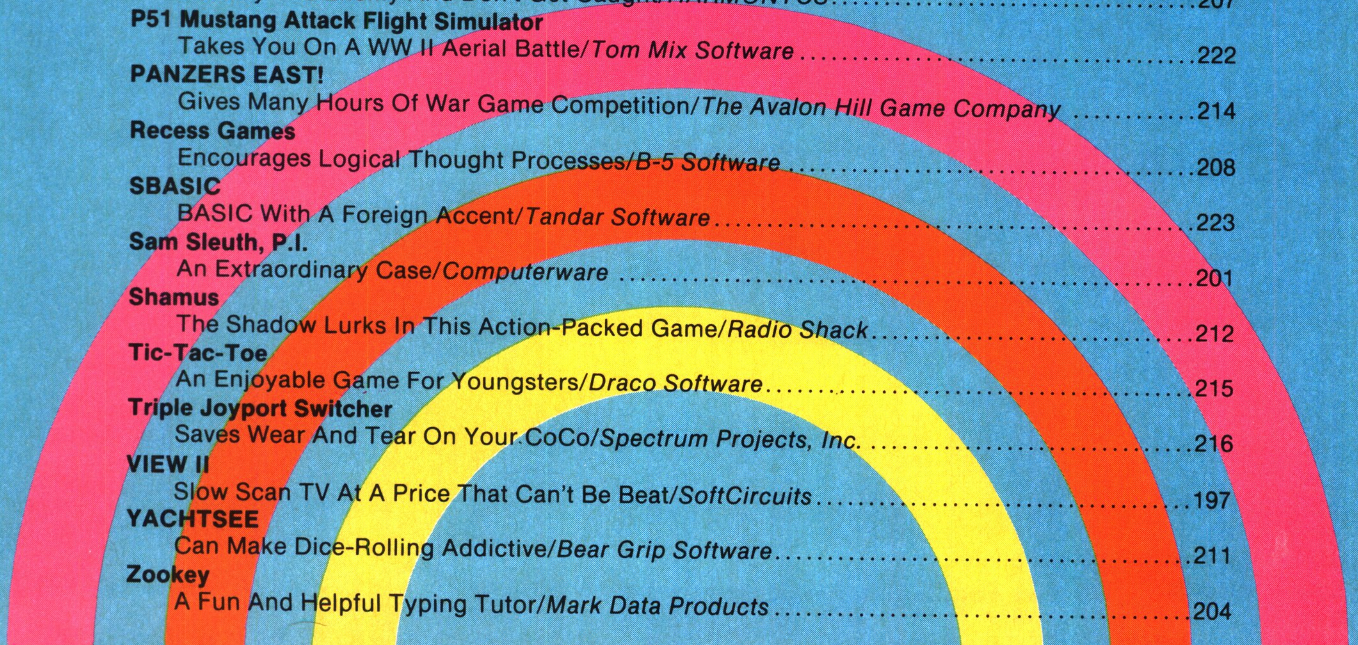

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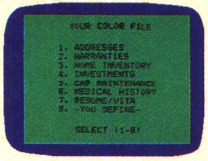

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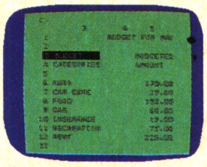

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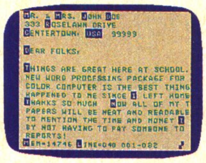

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TO MENTION THE TIME AND MONEY I
BY NOT HAVING TO PAY SOMEONE TO
REPORTS!
MEM=14746 LINE=040 001-082
```
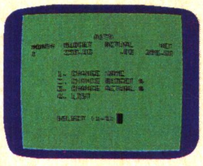
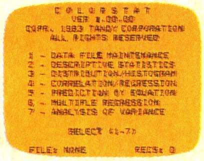

Personal Finance II. Includes 26 expense categories, including auto, gas, food and more. Review spending on year-to-date or category basis. #26-3106 **34^{95}**



COLORSTAT.** Use your Color Computer to turn complicated home or business data into statistics for easy analysis, or print them on an optional printer for your records. #26-3107 **24^{95}**



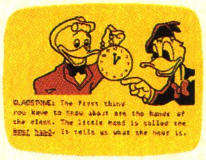
```
        C O L O R S T A T
          VER 1.00.00
  COPR. 1983 TANDY CORPORATION
      ALL RIGHTS RESERVED

1 - DATA FILE MAINTENANCE
2 - DESCRIPTIVE STATISTICS
3 - DISTRIBUTION/HISTOGRAM
4 - CORRELATION/REGRESSION
5 - PREDICTION BY EQUATION
6 - MULTIPLE REGRESSION
7 - ANALYSIS OF VARIANCE

         SELECT (1-7)

FILE: NONE          RECS: 0
```

*Joysticks required.
**Cassette recorder required.
***Joysticks and recorder required.

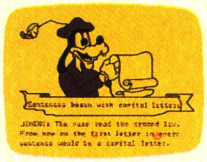
Educational Software from Walt Disney

Your Choice
34^{95} Each

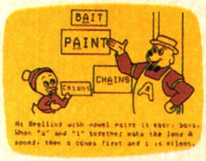
Telling Time with Donald.** Teaching your children to tell time is easy with a little help from Donald Duck. For ages 5-8. #26-2530



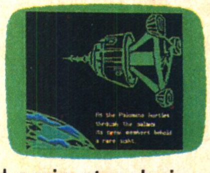
Mickey's World of Writing.** An exciting way to build important writing skills! Youngsters learn the basics of sentence structure and fundamental writing skills with Mickey Mouse. For ages 8-11. #26-2532



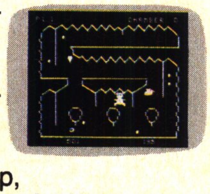
Mickey's Alpine Adventure.** A frosty exploration of spelling and reading concepts. Learn important spelling rules and the sounds of vowels and consonants with Mickey Mouse and Donald Duck. #26-2534



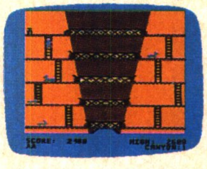
Space Probe: Math.** An exciting interstellar study of mathematical word problems. Youngsters learn the concepts of area and perimeter during outer space adventure. For ages 7-14. #26-2537



Downland.* You're alone in a secret cave, traveling from chamber to chamber collecting keys, gold and diamonds. But can you jump, climb and run to safety? #26-3046 **24^{95}**



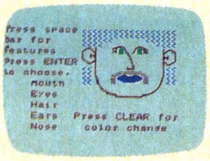
Canyon Climber.* Your climbing skills are under test when you find kicking goats, falling rocks, zinging arrows and more on your way to the summit. #26-3089 **34^{95}**



the Software You Color Computer

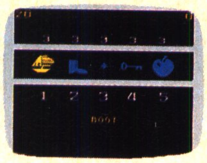
Learning Programs from Spinnaker

Your Choice
29^{95} Each

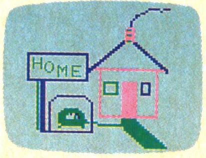

Press space bar for features
Press ENTER to choose.
Mouth
Eyes
Hair
Ears
Nose
Press CLEAR for color change

Facemaker. An exciting game to help your kids learn computer basics while they create an animated face. #26-3166

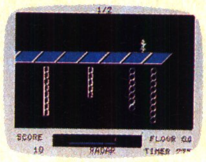
Kids on Keys. Your kids will enjoy learning with the computer as they identify numbers, letters and words. It's fun and your kids will learn important math and spelling skills. #26-3167



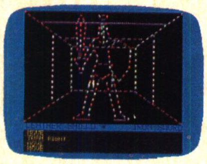
Kindercomp. Introduce your children to computer graphics! Even the youngest in your family will enjoy creating vivid color pictures and exciting sound effects by pressing a few keys. #26-3168



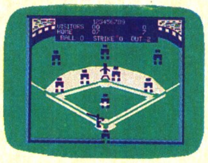
Fraction Fever. An exciting math contest! Your kids will develop a real understanding of fractional relationships as they guide their graphic "pogo stick" through this colorful game. #26-3169


1/2
SCORE
10
RADAR
FLOOR
TIMER

Dungeons of Daggorath. You're pitted against a succession of awesome beasts in the fearful dungeon. Each victory brings you closer to your ultimate foe—the wizard. #26-3093 **29^{95}**

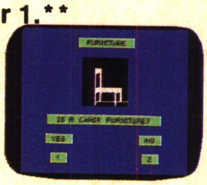


Baseball.* This exciting game plays just like the big leagues! You are the coach—it's up to you to control the pitching, defense, and running for extra excitement. #26-3095 **24^{95}**

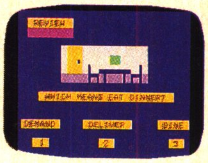

VISITORS
HOME
BALL 0
STRIKE 0
OUT 2

More Learning Fun for Your Kids

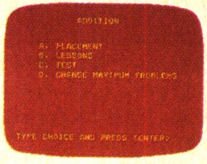
Vocabulary Tutor 1.** Give your children a head start in school. Start building their vocabulary at home with an exciting word and description matching game they'll love to play. For grades 3-5. #26-2568 **8^{95}**

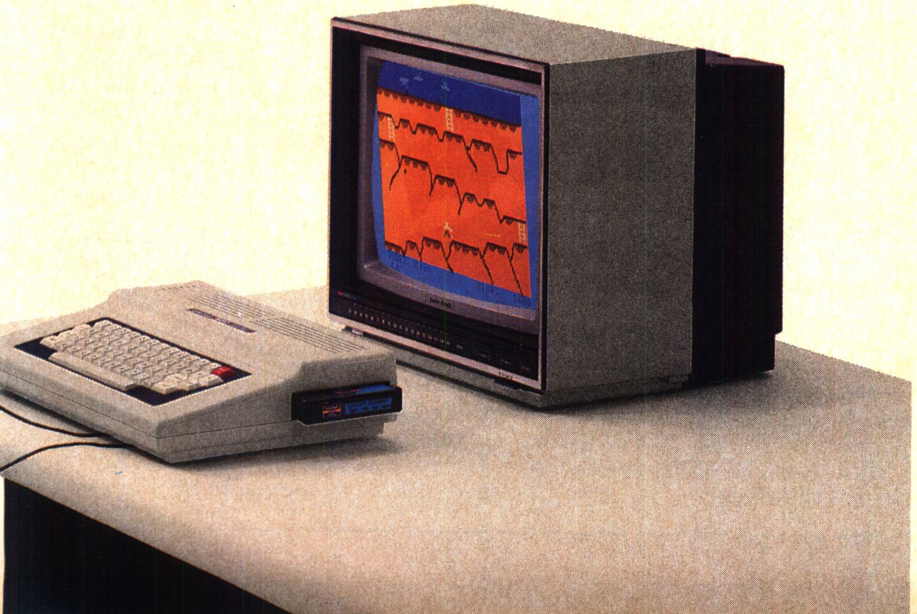

FURNITURE
IS A CHAIR FURNITURE?
YES
NO
1
2

Vocabulary Tutor 2.** More practice matching words and definitions and placing words in appropriate sentences. Great for helping young students get ahead. For grades 3-5. #26-2569 **8^{95}**


REVIEW
WHICH MEANS EAT DINNER?
DEMAND
DELIVER
DINE
1
2
3

Color Math.** Make learning fun. Supplement your children's study with problems in addition and subtraction. For ages 6-14. #26-3201 **19^{95}**


ADDITION
A. PLACEMENT
B. LESSONS
C. TEST
D. CHANGE MAXIMUM PROBLEMS
TYPE CHOICE AND PRESS <ENTER>



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The Technology Store™
A DIVISION OF TANDY CORPORATION

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Mail To: Radio Shack, Dept. 85-A-351
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RECEIVED & CERTIFIED

The following products recently have been received by THE RAINBOW, examined by our magazine staff and approved for the *Rainbow Seal of Certification*, your assurance that we have seen the product and have ascertained that it is what it purports to be.
This month the *Seal of Certification* has been issued to:

The Ultimate Color Computer Reference Guide And Toolkit, a book by David D. McLeod and Robert van der Poel which provides a comprehensive BASIC reference manual with command references, techniques to write more efficient programs and BASIC and machine language subroutines for incorporation into the user's programs. CMD Micro, Computer Services Ltd., 10447-124 Street, Edmonton, Alberta, Canada T5N 1R7, $27.95 U.S. plus $3.50 S/H, $34.95 CND. plus $3.50 S/H

The Software Kit For The Ultimate Color Computer Reference Guide And Toolkit, the tape or disk companion to CMD Micro's book, *The Ultimate Color Computer Reference Guide And Toolkit*, containing executable code for all subroutines discussed in the text. CMD Micro, Computer Services Ltd., 10447-124 Street, Edmonton, Alberta, Canada T5N 1R7, cassette $12.95 U.S. plus $1.50 S/H, $14.95 CND. plus $1.50 S/H, disk $14.95 U.S. plus $1.50 S/H, $17.95 CND. plus $1.50 S/H

Full Character Set Board, allowing CoCo to display the full 96-character ASCII set on the video screen by replacing the character set contained within the 6847 VDG chip in the computer. Also featured are true descenders on lowercase characters, braces and vertical bar characters and slashed zeros. CoCo Devices, Box 677, Seabrook, TX 77586, $38 plus $2 S/H

Look 'N' Listen, a 64K set of OS-9 utilities featuring 1) Screen, for Hi-Res display that is compatible with *O-Pak* but 27 percent faster; 2) stand-alone sound utilities that allow you to make sound through OS-9 independent of any additional hardware; 3) three boot routines: cold reboot, return to Disk BASIC, warm reboot, reboots OS-9 from drive /DO, make RS.Boot, makes an OS-9 diskette bootable even with Disk BASIC 1.0. Computerware, P.O. Box 668, Encinitas, CA 92024, disk $29.95 plus $2 S/H

DUDUL, a 64K ECB graphics doodling program requiring a joystick or mouse with screen services such as memory save, memory restore, memory exchange and file. Comes on cassette capable of being transferred to disk with a *Diskshow* program as well as a *Tapeshow* program. Doug Dugan, 4514 Wichita, St. Louis, MO 63310, cassette $22 plus $2 S/H

Remote Plus 1.1, a 64K host communications program requiring RS-232 or similar for use as both a stand-alone host routine or as a terminal driver routine within a BBS program. Featured are the recognition of all Extended BASIC and disk commands and the addition of 20 other commands. E.D.C. Industries, P.O. Box 42718, Los Angeles, CA 90050, $24.95 plus $2.50 S/H

ViziDraw, a 64K graphics utility requiring joysticks or a mouse to create graphics and text for output to printer such as camera ready layouts for advertising, article illustration and/or cover art. *ViziDraw* can be used to edit a printed page of text or standard full-screen, two-color Hi-Res graphics screens. Also, multicolor graphics is supported with `GET`/`PUT` and fill operations. GRAFX, P.O. Box 254, West Mifflin, PA 15122, cassette or disk $49.95 plus $2 S/H

Fast Food Math, a 32K ECB educational game designed to aid students, grades two through eight, in learning to handle money. There are four levels of difficulty ranging from the amount of change (calculated and displayed by the computer) to totaling the entire order, finding the sales tax, adding the two totals, computing the change and returning the correct change to the customer. MESA, Middletown High School, Valley Road, Middletown, RI 02840, cassette $24, disk $26 plus $2.50 S/H

Magic Lessons 1-3 and/or **4-6**, two 32K ECB programs requiring a disk drive to teach six different magic tricks. Each set comes with the necessary props to achieve the different effects. The text screen is Hi-Res with graphics illustrations to aid in mastering the tricks. Merlin's Software, 11515 Casey Rd., Tampa, FL 33624, cassettes $19.95 each

C Language Instant Reference Card, an 8½" by 11" plastic reference card providing a concise summary of C language for those using or learning C to avoid breaking concentration to go on a manual hunt while programming. Micro Logic Corp., P.O. Box 174, Dept. F, Hackensack, NJ 07602, $5.95 plus $1 S/H

More Keys, a 15-key numeric keypad to plug inside CoCo for the convenience of rapid numeric data entry. Comes with cable and connector; you must specify computer model. Moreton Bay, 316 Castillo Street, Santa Barbara, CA 93101, $69.95 plus $2 S/H

ALCATRAZ, a 32K ECB text Adventure. The scenario: You find yourself imprisoned unjustly and sentenced to death. You must escape to prove your innocence. Featured are many logic problems to test the skills of experienced players. Owls Nest Software, P.O. Box 579, Ooltewah, TN 37363, cassette $17.95, disk $20.95

Doomsday At 2100, a 32K ECB text Adventure which casts you as the secret agent who must escape captivity, locate and prevent a madman from launching a missile that will trigger global destruction. Pal Creations, 10456 Amantha Ave., San Diego, CA 92126 or CoCoNut Software, R.R. #2, Site 9 Box 1, Tofield, Alberta, Canada T0B 4J0, cassette $14.95

Cook Book, a 32K home utility requiring a disk drive that provides a database of approximately 320 recipes and features recipes according to compatibility with other foods and beverages, ease of preparation and cost, scaling of recipes either up or down to serve two to 99 people, creation of shopping list ingredients, printout of recipes and shopping lists, provides a Help screen of glossary terms and a timer to assist in meal preparation. Radio Shack stores nationwide, disk $39.95

CoCo Echo, a 16K printer utility that allows the user to dump a text screen to the printer. Tothian Software, P.O. Box 663, Rimersburg, PA 16248, cassette $9.95

Solar Explorer, a 32K ECB electronic book providing an introductory course in astronomy. Featured are basic facts about the planets in our solar system, Earth's moon, the planets' distance from the sun, length of years for planets, temperature, diameter, gravity, density, mass and atmosphere for each "wanderer." Radio Shack stores nationwide, $19.95

Guide To Super Software for the TRS-80 Color Computer, a book by Scott L. Norman which discusses most of the major applications software for the CoCo, including word processing software, spelling checkers, mail-merge packages, spreadsheets and database managers. Scott, Foresman and Company, Professional Publishing Group, 1900 East Lake Avenue, Glenview, IL 60026, $18.95

Aut-O-Start, a 16K utility to autostart your BASIC or ML programs with title screens using a mixture of text and graphics. Spectrum Projects, Inc., P.O. Box 21272, Woodhaven, NY 11421, cassette $19.95 plus $3 S/H

Datarase, a compact EPROM eraser that will accept either 24- or 28-pin devices. Provided are two slots into which the user slides the EPROMs to be erased. Each slot has a thin metal shutter to prevent UV light from escaping when not in use, allowing the EPROM to be placed close to the lamp which reduces erase time. Spectrum Projects, Inc., P.O. Box 21272, Woodhaven, NY 11421, $49.95 plus $3 S/H

Triple Joyport Switcher, an accessory that allows switching back and forth of joysticks, mouse, touch pad and/or light pen. Spectrum Projects, Inc., P.O. Box 21272, Woodhaven, NY 11421, $39.95 plus $3 S/H

Super Voice, a 32-64K speech synthesizer allowing the user to write talking BASIC programs, specifying inflection, intonation, articulation and filtration. Also possible are music, singing over a six octave range and sound effects. Speech Systems, 38W 255 Deerpath Road, Batavia, IL 60510, $79.95 plus $2 S/H

CoCo Testem, a 32K ECB education utility requiring an 80-column printer with underline function to create and print tests. Possible are the creation of multiple choice, fill in the blank, short answer, true/false and matching tests. Tothian Software, P.O. Box 663, Rimersburg, PA 16248, cassette $19.95

Graphic Physics, a 16K ECB educational aid allowing the exploration of concepts in physics. Tothian Software, P.O. Box 663, Rimersburg, PA 16248, cassette $19.95

Lissajous Art, a 16K ECB graphics program requiring a dot matrix printer such as the DMP-110 or LP VIII to create and print out intricate Lissajous figures. Tothian Software, P.O. Box 663, Rimersburg, PA 16248, cassette $19.95

School Days, a 32K ECB game which presents true to life teaching experiences and challenges you to make the choice that will benefit the students, impress the administration and preserve your sanity. Tothian Software, P.O. Box 663, Rimersburg, PA 16248, cassette $19.95

Screen Inverter, a 16K BASIC utility that allows the user to write BASIC programs on a dark text screen with light letters. Tothian Software, P.O. Box 663, Rimersburg, PA 16248, cassette $9.95

Sound Generator, a 16K ECB program that will draw sound waves as you hear them and make machine language sound that can be EXECuted by BASIC. Tothian Software, P.O. Box 663, Rimersburg, PA 16248, cassette $19.95

Ledger One, a 32-64K ECB financial utility for single entry bookkeeping and accounting requiring a disk drive for random access data storage and processing. Possible are the recording of several hundred transactions and the selection of any two dates for *Ledger One* to display all transactions made in that interval. The same data may be sent to the printer at any time, as well as viewed on the screen. West Bay Company, Route 1, Box 666, White Stone, VA 22578, cassette or disk $20

The *Seal of Certification* program is open to all manufacturers of products for the TRS-80 Color Computer, the TDP-100, or the Dragon-32, regardless of whether they advertise in THE RAINBOW. By awarding a *Seal*, the magazine certifies the program *does exist*, but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to THE RAINBOW'S reviewers for evaluation.

— Monica Dorth

16K Tape — Extended Color BASIC
32K Disk convertible from tape*

DO YOU KNOW HOW MUCH CASH YOU *REALLY* HAVE?

Do you know if you will run short of cash any time in the next year? If you know you won't, do you know the minimum cash surplus you'll have in the next year?

Either way, you'll gain from using the

CASH PROPHET

available from Everyones Computer Co.

The CASH PROPHET is an easy-to-use, high quality, menu-driven, household budget system that eliminates the hassle of recording every penny spent. No double-entry bookkeeping here!

It prophesies your future checking account balances and two interest-bearing savings accounts.

It's dynamic: it can re-forecast the next 52 weeks any time your household's income or spending plans change or you "bust" the budget.

It's the lazy man's budget system: it saves your regular expenses on tape or disk for recall. You can enter repetitive weekly, bi-weekly, and monthly income with a single record.

Your expenses vary from month to month. You have bi-monthly, quarterly, semi-annual, and annual expenses — some of them large. You can't possibly remember them all. The CASH PROPHET reminds you when each is due.

If you are paid weekly or bi-weekly you will appreciate how the CASH PROPHET recognizes that some months have more paychecks than others. You will applaud when it automatically compensates for the differences.

It was designed to report on the screen but will print out on demand.

It can schedule thousands of transactions under 73 different headings!

The CASH PROPHET runs from tapes on CoCos with as little as 16K (Extended Color BASIC)! It is only sold on cassettes and comes with complete instructions that even novice CoCo users will understand!

** Instructions are included to easily convert operations from tape to 32K disk.*

You may personally use the CASH PROPHET for only (U.S.) $39.95! Shipping and handling charges are included in the continental U.S.; $5 extra in Canada; $15 extra otherwise.

To order, send your check or money order to:

Everyones Computer Co.,
P.O. Box 771-R,
Chesterfield, MO 63017.

Your money back if the CASH PROPHET can't handle your household budget.

Dealer inquiries invited

REVIEWING REVIEWS

LIBRARY I

Editor:

I was disappointed by the review of *Library I* in the April 1985 issue of RAINBOW [Page 195]. The review does not provide enough information for the potential buyer to decide whether or not *Library I* is worth owning.

Library I is a productivity tool specifically for use on a CoCo with *Color Disk EDTASM*, and at least 32K and one disk drive. This is a package for the assembly language programmer, from novice to expert, who is using *Color Disk EDTASM*.

Perhaps the simplest way to demonstrate the ease of using this package is to show the code necessary to define, open, read and close a disk file in assembly language using *Library I*. For this example, assume an assembly language program in which the *Library* source files have been included. The section of code needed to define, open, read and close a disk file would be:

```
DCB        F1, "NAME", "EXT",
           PBUF, LBUF,25,4
DOPEN      F1
DREAD      F1
DCLOSE     F1
```

The review states that "the package does well what it sets out to do." What Sadare Software set out to do with *Library I* was increase the productivity of assembly language programmers by removing the tedium of coding mundane tasks. This was accomplished by providing macros calls that use a clear and consistent syntax. We did the mundane tasks so the assembly language programmer can concentrate on the creative. We feel that we did well what we set out to do.

Craig Hunt
Sadare Software

Editor:

The package, as I said before, does its job well, and its documentation is admirable. Given that I have indicated what that job is and who might be expected to find it useful, what more, within the confines of a brief notice, need be said?

R.W. Odlin
Sedro-Woolley, WA

LIZPACK

Editor:

I enjoyed the review of *LIZPACK* in the March 1985 issue [Page 212]. The address at the end of the review, however, was the author's and not that of Prickly-Pear Software; 2640 N. Conestoga Avenue, Tucson, AZ 85749. Also, *LIZPACK* retails for $195 instead of $200.

Joanne Chintis
Prickly-Pear Software

QUIZ KIDS

Editor:

We would like to thank the reviewer of *QUIZ KIDS* for his detailed and thoughtful review.

The intention of *QUIZ KIDS* is to introduce the child to a learning environment similar to BASIC, so that the eventual transition from LOGO to BASIC will be easier. The brisk sales of *QUIZ KIDS* confirm that this program fills a long-standing void in the educational software available for the CoCo.

Bernice Klein
B & B Software

MAZE RUNNER

Editor:

Thank you for reviewing *Maze Runner* (April 1985, Page 217) and the kind words of Bruce Rothermel. I can appreciate Bruce's problems with being a perpetual trainee. I wrote the program, but it is my children who occasionally make it through the inner circle and on to a treat Bruce and I may never experience, the Mother Maze. For those of you contemplating the challenge, you may not be aware that Harmonycs and Color Connection merged. *Maze Runner* (and my other programs: *Amortization, Match & Spell, TIC-TAC-TOE MATH* and *DIET-ADE*) can now be purchased from Color Connection Software, 1060 Buddlea Drive, Sandy, Utah 84070. The price is the same.

Dennis O. Dorrity
Color Connection Software

DATALIST

Editor:

We would like to thank RAINBOW and Gary Smith for the complimentary review of *DATALIST* in the March 1985 issue [Page 218].

The latest version of *DATALIST* provides the additional capability of totaling any or all fields for report purposes. There is now a disk version of *DATALIST* with the added feature of allowing tape files to be loaded by the disk version.

We hope these comments will be helpful to your readers and we commend Gary Smith for his fine review.

Arlin Karger
Computer Associates, Inc.

BURNER+

Editor:

I would like to thank RAINBOW and Mr. Ellers for reviewing our product, the Burner+, in the February 1985 issue [Page 228]. Overall, the review was very complimentary with only two minor errors.

Mr. Ellers pointed out that the Burner+ will program the 2708 EPROM. The 2708 is an old 1K EPROM that is very rarely used today. The reason for this is that the 2708 requires three separate power supplies (+5V, -5V, and +12V). The Burner+ will only program single supply (+5V) EPROMs. Luckily, multi-supply EPROMs are not used in modern systems.

In regard to 16K EPROMs (27128), Mr. Ellers stated that the last few hundred addresses of these cannot be programmed. This is not true. The entire 16K of these EPROMs can be programmed by the Burner+. The only restriction is in reading the last 256 addresses when you deselect Disk BASIC. This means you could have Disk 1.0 in one half of the 27128 for compatibility's sake, and some Super DOS in the other half for all those special features. This EPROM could then either stay in the Burner+ or it could be mounted inside the controller to free up the Burner+.

Once again, thanks to Ed Ellers and THE RAINBOW.

Peter Pollak
Pollak Electronics

Custom Software Engineering, Inc.

807 Minutemen Causeway (D-2), Cocoa Beach, Florida 32931
(305) 783-1083

For information or technical support, please call between 5:30 and 8:30 P.M. Eastern time.

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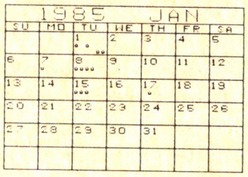
puts YOU in charge of your schedule!


1985 JAN
SU MO TU WE TH FR SA

- Graphically displays any monthly calendar between 1700 and 2099. You put in up to twelve 28 character memos per day . . . calendar shows where the memos are . . . call up of day shows details.
- Use for appointments or a log of past activity.
- Search capability allows you to list or print all memos between two specified dates or only ones meeting key-word criteria.
- Date computation shows elapsed time between two dates in days, weeks, months and years.
- Printed graphic calendar available with optional Screen Print Program.
- Requires 32K in BASIC

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```
 1
  43
 +69
 102
1+4+6=11
```

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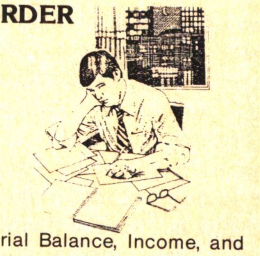

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That's the theme of *Galactic Fighter*, an arcade-quality space game developed and marketed by Four Star Software. And while neither the theme nor the action within the game are completely original, the graphics are good, the action is fast and the challenge is continuous.

The invaders have used fusion bombs to destroy most of the earth. Cities have been obliterated to make room for fields. And survivors are being herded by the millions into prisons. Your mission is to deliver a device to Dracoz that will end the assault on Earth.

Obviously, that's easier said than done because in order to get to the other planet, you're going to have to survive wave upon wave of flying objects — some of them natural debris that you'd expect to encounter in space, such as asteroids and meteors. Others take the shape of guided missiles, alien fighters and enemy transporters.

As the game begins, you are given the option of setting the level of play — easy, medium and hard. You probably should start at the lowest level since all three levels are fairly difficult. You receive five turns per game, with an opportunity to earn an extra turn for every 25,000 points you put on the scoreboard. Points are allocated as follows: asteroids, 25; meteors, 50; missiles, 200; fighters, 250; transporters, 500. When you reach 25,000 points, you enter a laser trench. There's no relief there because the aliens have already arrived.

Meteors and asteroids flow toward you continuously from the left side of the screen during your mission. Fighters usually appear first at the upper right-hand corner, cross the screen and then attempt to knock you out of the atmosphere — either with bullets or by bumping into you. From below missiles are launched, sometimes by the dozens.

If things get too far out of control, you have an option of pressing the space bar to destroy all enemy objects on the screen. You can only use this option twice, however. There is a pause feature, but if you wait until an object is right upon you, it's going to get you sooner or later.

The only thing working against *Galactic Fighter* is that it's the latest in a long, long line of space games. If that doesn't bother you, you will enjoy this challenging and nicely done effort. You may even spend hours trying to save the Earth like this reviewer did.

(Four Star Software, P.O. Box 730, Streetsville, Ontario, Canada L5M 2C2, tape $19.95 U.S., $24.95 CDN., disk $24.95 U.S., $29.95 CDN.)

— Charles Springer

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Now, we cover five of the most exciting computers on the market, as well as the most productive — the highly popular Model 100; a brand new portable, the Tandy 200; and Tandy's new MS-DOS computers, the Tandy 2000, Tandy 1200 and Tandy 1000.

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- Un-DISK should be in the library of every serious CoCo user even if you own a disk says Frank J. Esser, independent reviewer for RAINBOW Magazine!

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Congress Takes You On A Presidential Quest

By Theodore S. Arrington

Leadership of Congress is one of the most challenging and important tasks of the American presidency. Yet many citizens have little understanding of the nature of this relationship. One way to learn about this part of the political world is to be elected to office and get on-the-job training. If that is more commitment than you can manage right now, a computer Simulation, such as the one written by Jeff Stevens of B-5 Software, is the next best thing.

His program, appropriately called *Congress*, is not just a game or merely a teaching program. It is a true Simulation. When a computer program copies something from the real world with careful attention to the accurate reproduction of essential parts and their interrelationships, this is called a "Simulation."

Congress requires 32K and Extended BASIC. I reviewed the disk version which loaded without any problems and can be backed up with normal procedures. The documentation is adequate, clearly written and includes hints on the use of the software as a teaching aid.

The Simulation first gives the user a Hi-Res picture of the Capitol and some music; then comes an application form to apply for the presidency. This gives the computer information on the user and sets some variables in the Simulation, such as the president's party. The application has a place for the user to give his/her name, which allows the computer's responses to be personalized.

The computer then asks the new president/user to choose between two possible policies on each of a number of prominent political issues. These issues are current, but may seem dated to students in two or three years. In most cases, one of the choices offered on each issue is conservative and one is liberal, but these choices are not strategic. That is, if the Congress is overwhelmingly Democratic, then a president would find it easier to push liberal measures through than conservative ones. This is not the case here, as this element of strategy has been simplified away. The policy choices are merely to give the user the feeling of pushing policies he/she believes in.

The user also chooses which party to join. This is an important choice, because the computer will determine the party lineup in each house of Congress by a random function at the beginning of each game, and the proportion in the president's party in each house largely (but not totally) determines success. The user has to choose a party before knowing the outcome of the election.

All this is true to life in that party is the most important variable in presidential success in Congress and a president's party may do relatively well or badly in congressional elections. It would be nice if the program had a version in which one could pre-set the party proportions. Because the party division changes for each game, it is hard to tell which strategies are most effective. For example, in one round my party might be the minority in each house. I might make all the right stragetic decisions and still get a very low score. In the next round I might make wrong choices, but win because my party dominated both houses. While this is very realistic, it might not aid learning as much as a separate version which allows the setting of this important variable.

The president/player also gets to choose which of several states he/she wishes to bless with pork barrel benefits to help win support for the rest of the president's program. I assume that it is best to choose the most populous states, but I can't tell because the effect of party realistically wipes out the effect of pork barrel choices. This means I would have to play hundreds of games and record the results to detect the proper strategy — or sneak a look at the code.

Then the game starts. Simple Y/N or numerical choices from a menu allow the president/user to make choices. The program is interesting visually and includes good error trapping. For example, if the choices are '1' to '6' and one types anything else, it sounds a musical note and prompts one to try again. The only annoying feature is that between parts of the game and at the end the computer draws a Hi-Res picture of the American flag and plays one of several patriotic songs. One should be able to cut these musical interludes short by pressing ENTER.

In play, the user must choose which policy to push first. There is no sign that this is a strategic choice, except that one might run out of time before everything is passed. Thus, the player might first push the policy he/she most favors. This would not yield more points, but might make a psychological difference. The Simulation realistically places time limits on the player, but this is not "real time." Rather there is a 24-month counter in the game to reflect the two-year term of Congress. As one tries to push pieces of legislation through the various parts of the legislature, this counter slowly ticks away.

During the play, the computer tells you where your

One-Liner Contest Winner . . .

1LineZap is a one-line disk zap program that will allow users to look directly at all sectors on a disk to see what they contain. At the bottom of the screen are two numbers; the first is the track number (between zero and 34) and the second is the sector number (between one and 18). You can change tracks and sectors using the four arrow keys. If you get an ?FC Error message, it means you are trying to read a track or sector that is not on the disk. If this happens, simply run the program again.

The listing:

```
0 CLS:CLEAR500:T=17:S=1:FORC=0TO
1STEP0:DSKI$D,T,S,A$,B$:PRINT@0:
PRINTA$;B$:PRINT@384,T,S:I$=INKE
Y$:IFI$="^"THENT=T-1:CLS:NEXTELS
EIFI$=CHR$(8)THENS=S-1:CLS:NEXTE
LSEIFI$=CHR$(9)THENS=S+1:CLS:NEX
TELSEIFI$=CHR$(10)THENT=T+1:CLS:
NEXTELSENEXT
```

Eric Tilenius
Huntington Station, NY

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape.*)

legislation is in the congressional process. Thus, with repeated usage the player will learn the complicated procedures of the Congress. The programmer has, in part, simplified these procedures. One example is that most legislation can originate in either house, and most bills are introduced into both houses at the same time, but in *Congress* it is described as if a bill starts in the House of Representatives and then goes to the Senate. However, sometimes action in committee is so fast that the player cannot really tell what is going on and appreciate the process. (Subcommittees and the Rules Committee in the House of Representatives are simplified out of existence.)

Occasionally, the process stops and the computer asks whether the player wants to use one of the favors that members of Congress owe to reduce the number of amendments to a bill, discourage new amendments, or help passage. These prerogatives or tools for persuasion are limited in number. Thus, the president/user learns the value of conserving resources to gain maximum advantage. If the president's party has sufficient support in both houses and he/she uses these resources properly, then some bills will get through Congress with few amendments.

This success determines the score. The rate is 100 points per bill for a maximum of 500 points. Less than 100 points is awarded if Congress attached more than five amendments to a bill. After 10 amendments, one actually loses points if the bill is signed or passed over a veto. Deciding whether to sign a bill with five to ten amendments or veto it is realistically tricky, but the Simulation could be better if the threat of veto could be applied earlier.

For example: "The committee tells me that they can pass your bill with six amendments. Will you sign such a bill?" The player would then have to decide whether to take this "half a loaf" or threaten veto and try to get a better deal by using some owed favor. This illustrates my main criticism of the program: that the president is too much of bystander to the process. He/she makes decisions to affect the outcome only sporadically. This feature is true to life, but it serves to teach the frustrations of the presidency at the expense of greater learning about how presidents persuade members of Congress, and other political actors, to go along.

When the president/player gets all of his/her legislation passed or runs out of time, the computer tallies up the score. It then compares the performance to that of other presidents. If you do very poorly, it compares you to Jimmy Carter and suggests that your popularity is comparable to that of Nixon during Watergate or Johnson during the Vietnam War. If you do somewhat better, you may be compared to Jefferson or Truman.

My suggestions for improvement should not imply that this is a bad piece of software. On the contrary, *Congress* is a super program. It simulates and teaches some very important political concepts: Congressional procedures, conservation of political resources, importance of party support, allocation of resources, the importance of big states, the feeling of helplessness as Congress works over programs, and the fact that the opportunity for presidential influence is sporadic. Moreover, it is interesting and fun to play, at least for a while.

It should be used, however, in the manner suggested in the documentation. It is of limited use if a teacher just gives it to a student and says "Here, go play with this and be quiet." The student needs to talk the strategies over with other students and be led by a knowledgeable instructor. When used in this way, I think *Congress* is appropriate, as the manufacturer suggests, in any grade from junior high school and up. It would even work at the state university where I teach. If I could only get Congress to approve more money to buy additional CoCos!

(B-5 Software, 1024 Bainbridge Place, Columbus, OH 43228, cassette $29.95, disk $31.95)

One-Liner Contest Winner . . .

This one-liner will, whenever you input a command, produce what looks like a cold start. It will run on any CoCo, but you should modify it to match the computer you use.

The listing:

```
1 CLS:PRINT"DISK EXTENDED COLOR
BASIC 1.0    COPYRIGHT (C) 1981 B
Y TANDY      UNDER LICENSE FROM M
ICROSOFT":PRINT:PRINT"OK":LINEIN
PUT"";L$:CLS:FOR T=1TO1500:NEXT
T:GOTO1
```

Jeff White
Tampa, FL

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape.*)

BASIC COMPILER

MLBASIC 1.0 - BASIC COMPILER

WASATCHWARE is pleased to introduce what we feel is the most comprehensive BASIC Compiler available for the Color Computer. This BASIC compiler, called MLBASIC, is for programmers who want to create machine language from BASIC programs. Written in machine language, MLBASIC will prove to be the most powerful utility on your shelf.

COMMANDS SUPPORTED

```
1. I/O -Commands
     CLOSE    CLOADM   CSAVEM   DIR      DRIVE    DSKI$
     DSKO$    FIELD    FILES    GET      INPUT    KILL
     LSET     OPEN     PRINT    PUT      RSET

2. Program Control Commands
     CALL     END      EXEC     FOR      STEP     NEXT
     GOSUB    GOTO     IF       THEN     ELSE     ERROR
     ON..GO   RETURN   STOP     SUBROUTINE

3. Math Functions
     ABS      ASC      ATN      COS      CNV      EOF
     EXP      FIX      INSTR    INT      LEN      LOG
     LOC      LOF      PEEK     POINT    PPOINT   RND
     SGN      SIN      SQR      TAN      TIMER    VAL

4. String Functions
     CHR$     INKEY$   LEFT$    MID$     MKN$     RIGHT$
     STR$     STRING$

5. Graphic/Sound Commands
     COLOR    CLS      CIRCLE   DRAW     LINE     PAINT
     PCLEAR   PCLS     PLAY     PMODE    PRESET   PSET
     RESET    SCREEN   SET      SOUND

6. Other/Special Commands
     DATA     DIM      LLIST    MOTOR    POKE     READ
     REM      RESTORE  RUN      TAB      VERIFY   DLD
     DST      IBSHFT   LREG     PCOPY    PMODD    PTV
     REAL     SREG     SWP      VECTD    VECTI
```

WASATCHWARE believes that the 6809 based microcomputer is powerful enough to warrant such a compiler. MLBASIC is a BASIC compiler that allows structured programs (using SUBROUTINEs), full floating point arithmetic and other features not available with Interpreter Basic programs.

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VIEW II: Slow Scan TV At A Price That Can't Be Beat

If the true reason were known for my interest in computers, especially the CoCo, I would have to use ham radio as a starting point. I have said all along that in addition to having one of the most advanced microprocessors, the CoCo's peripheral ports are there, limited only by the programmer's ingenuity. Needless to say, when I received the *VIEW II* package for review, I was elated at the prospect of transmitting and receiving SSTV (Slow Scan Television) just by a direct connection between my ham transceiver and my cassette port.

Actually, this review covers two separate products. *VIEW II* is the software necessary to convert your CoCo into an 8.5 second black-and-white slow scan transceiver. The *Coco Grey* is a hardware modification to the CoCo that allows a Hi-Res screen of 128 by 128 pixels with 16 gray levels.

Another product, called *View-Edit*, consists of a package of image generation and enhancement utilities that allows editing of all types of graphics information. *View-Edit* will be reviewed at a later date.

To use *VIEW II*, you must have a 64K CoCo and at least one disk drive. A monitor is necessary for the *Coco Grey* as it provides composite video out.

As you may know, there are a few packages on the market for the reception of SSTV with the CoCo. They all require extensive modification to the CoCo in the way of external hardware. With the *VIEW II* software, you just input SSTV audio onto your cassette port and watch the picture appear on your screen. Sending a picture is just as easy; just plug the output of your CoCo into your transmitter.

There are several utilities for storing and retrieving pictures from disk. If a picture is received that you really like, saving it to disk is a snap. Conversely, the pictures you wish to send can be loaded from a menu-driven routine that allows picture selection by the touch of one key. All of the features of *VIEW II* can be accessed by either the keyboard or a joystick.

One nice feature of *VIEW II* is a digital zoom feature. Upon selecting zoom, a one-quarter size rectangle appears allowing you the choice of which part of the picture you wish to enlarge. It is fun to watch the process as it is accomplished on the screen.

Another utility allows screen dumps of the image in memory. Drivers are included for Epson, PMC and DMP printers. We used the Epson driver for a Gemini-10X and it worked fine.

With *VIEW II* you are given the software to convert images produced by the Micro Works DS-69 Digisector to a *VIEW II* format. This is nice for live pictures, or maybe snatching screens from TV or video tapes. The images can then be stored in the *VIEW II* format.

The standard Hi-Res screen of the CoCo can only produce five levels of gray. This is OK, but not acceptable for most video information. To remedy this situation, SoftCircuits has designed a hardware board using advanced real-time video enhancements to provide 16 gray levels.

The board measures 2.5 by 2.9 inches and fits on a piggyback socket arrangement on top of the 6847 VDG chip. I have an 'E' Board and had to permanently remove part of the top shield for the connection to the VDG. Elaborate instructions are given on installation on the various CoCo boards.

The *VIEW II* software is the actual SSTV package, but it is greatly enhanced by the *Coco Grey*. Pictures were actually sent and received with this combination. Several demo pictures are provided on the disk which attest to the quality of video that is possible. I am not trying to say this is the best SSTV receiver I have seen, since obviously the filtering on some commercial units is far superior to the zero crossing detector used in the CoCo. At the same time, from an economic standpoint, it can't be beat. I'm on slow scan now for less than $150 and can do things with pictures that people with 10 times that amount invested can't do!

(SoftCircuits, 401 S.W. 75th Terrace, North Lauderdale, FL 33068, *VIEW II* disks $24.95 each, *VIEW-EDIT* disks $24.95 each, CoCo Grey $100)

— Dan Downard

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ColorStat — A Good Statistical Program For Beginners

By J.B. Garner

I have taught, researched and consulted in statistics since 1961, and for the last 12 months I have been using my CoCo to perform statistical calculations on small data sets. Color BASIC contains good mathematical subroutines and is an easy, flexible language with which to program (especially when enhanced by the J&M DOS). With CoCo, I have been able to perform logistic regression and other routines which some well-known mainframe statistical packages, such as *SPSS* (Version 8) are unable to do.

ColorStat is a small program on tape which enables the user to construct a data file of limited size and then perform various limited statistical calculations on the data it contains.

The uses of the program are very clearly explained in a well-produced 49-page manual. This manual is about the clearest and best produced I have seen. However, it explains how to use the program, not how to understand the program's output.

The first menu offers data file maintenance, descriptive statistics, frequency distribution and histogram, correlation/linear regression (and the paired sample t-test), prediction from this regression equation, multiple regression (with two independent variables), and analysis of variance for the one-way experimental design. The data file maintenance section guides the user on how to prepare a new file, rename the present file, rename a variable, add records to a file, display, update, print a file, read a file from tape and to write a file to tape.

Files are produced in the usual statistical layout by placing the data into a rectangular array with rows representing subjects, such as people or animals, and columns representing the variables, such as age, weight, height measured on each subject. The program describes each row as a "record," and carefully guides the user to make an appropriate data file.

In the 16K version of the program, a `DIM` statement in the first line limits the user to 75 records of six variable values each. On the reverse side of the tape, a 32K version of the program appears identical, apart from lines 1 and 9500, allowing 500 records of six variables each. With some tenacity, these limits may be altered by the user.

The program is written in BASIC and may be placed on disk, listed, copied or altered without any problems. The only time a `POKE` statement is used is to determine whether the printer is ready. The use of BASIC allowed me to see exactly how each calculation was performed and to be able to make this review more helpful to the reader.

If you wish to use a disk, you should change the device number of certain input and output statements; if you wish to print the histogram or scatterdiagram on the CGP-115, you must remember to switch to the 80-column mode (as these diagrams are printed by means of X's and zeros). All program output may be switched to a printer to give a permanent version, as may a copy of each record.

In trying to use the program without reading the manual the only difficulties I had were the abbreviations "DV" for the dependent or outcome variable, and "IV" for the independent or input variable.

The output for descriptive statistics gives the mean (average), sum, sum of squares (not the more usual sum of squared deviations!), standard deviation (divisor N), standard deviation (divisor N-1), the minimum and the maximum, for any selected variable.

The output does not give the sample size, the standard error of the mean or the name (or number) of the relevant variable. The distribution/histogram choice gives a frequency distribution in, at most, five (equally spaced) cells and a corresponding block diagram in attractive colors. The axes of the block diagram do not contain any labeling. The manual advises this may be added by means of the *GRAPHIC* package (Cat. No. 26-3157/Cat. No. 26-3251).

The correlation/linear regression selection gives the means of the two variables, the correlation between them and the slope and y-intercept of the regression of 'y' (the DV) on 'x' (the IV). It does not give the t-test value for the correlation (slope), the sample size, the standard error of the slope or the standard deviation of the scatter about the regression line. On the other hand, if 'y' and 'x' were paired samples (such as scores on the same people before and after treatment), the program does print out the value of the relevant paired t-test and its degrees of freedom. A Lo-Res scattergram with or without a plot of the regression line is available. The prediction selection, made after the correlation selection, prints out the predicted 'y' value for any 'x' value you may wish to input. The standard errors of these predictions are not given.

Choosing multiple regression enables you to regress one variable on two others. In this section the printout is

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essentially complete. Unfortunately, as it stands there is a flaw in the program. Using the data given in the manual, namely four records containing age, sex and income, and repeatedly running the multiple regression of age on sex and income, I obtained a different equation on each occasion! The problem is that one accumulating variable, X2(6), is not cleared to zero before use. Change `J=1 TO 5` to `J=1 TO 6` in Line 8500 to remove the difficulty.

The final selection enables the user to obtain a one-way analysis of variance together with the means and standard deviations of the separate treatment groups. Here the omission of the separate sample sizes is more of a difficulty, and in Line 6820 the denominator of the expression for the standard deviation appears incomplete, 'N' being written for (N1(J)-1). The result is that the standard deviations given by the program are (very often) incorrect.

Minor errors I have found in the manual are stating the filename to have a maximum of eight characters whereas the program, Line 265, allows 10: the DF BETWEEN in the table on Page 39 should have value one, not zero; the suggestion that data values may be up to 15 characters in length on Page 11 (Color BASIC stores about nine significant digits). The main drawback to the manual is the lack of a small appendix giving precise definitions to each term used in the various outputs. For example, the descriptions on the descriptive statistics section are not consistent with those used later. I had to work through the program in order to be clear about the definition of each term.

Considerable care has been taken to make the screen appearance attractive and the creation of data files straightforward. Less care has been taken with the selection of presented statistics and the programming details.

Statistics is now being taught in high schools, and with these two small programming errors corrected, this would be a useful accompanying program. It does not quite cover the curriculum of the usual college introductory statistics semester.

Standard error of the mean, single sample t-tests, the binomial distribution and chi-square analysis of contingency tables are not contained in *ColorStat*. If the formulas for the output results had been given, then this would have been a very useful program for people attempting to learn statistics by themselves, as it would have removed the drudgery and allowed them to concentrate on the new ideas.

(Radio Shack stores nationwide, cassette $34.95)

One-Liner Contest Winner . . .

Design draws a box that shrinks and changes shape.

The listing:

```
10 PMODE3,1:SCREEN1,1:PCLS:FOR Q
=1TO5:X1=0:Y=191:X3=255:FOR Z=1T
O 190:COLOR RND(8):LINE(X1,X1)-(
X3,Y),PSET,B:X1=X1+1:X3=X3-1:Y=Y
-1:NEXT Z,Q
```

Dan Wittig
Warren, PA

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape.*)

Software Review

CoCo Professional Tax Preparer Is An Excellent Tax Aid

Are you tired of seeing your computer sit around doing nothing? Would you like to make some extra dollars by using your CoCo? Would you like to do your own taxes just like the professionals without paying the professionals?

If you answered yes to any or all of the above questions, then you owe it to yourself to read on.

Micro Data Systems has made available a program that can do all of the above. The program is called *The CoCo Professional Tax Preparer* and was designed by a tax consultant with 15 years experience. The program runs in 32K memory and requires one or two disk drives. The package consists of a professionally prepared one-inch notebook binder compiled of approximately 350 pages packed full of perfectly written documentation along with step-by-step examples.

The manual is broken down into eight color-coded sections consisting of: General, Income, Adjustments, Itemized deductions, Tax computation, Credits, Other taxes, and Appendix. Whatever section you are in need of, it is just a matter of flipping straight to the section for a detailed description of that particular category.

Also included in the package is a file containing all of the government income tax forms. An added extra is a book called *Miller's Personal Income Tax Guide* (a $7.95 value). This book offers detailed step-by-step worksheets that take you line by line through complex tax calculations, which is ideal for the beginner who has never completed a tax form before. Together with the program and the tax preparation book, it makes income tax calculating a breeze.

The program consists of four diskettes, three program disks and one data disk. All disks are not copy-protected, which allows the user to make backup copies. After initiating the system, the program will prompt you with entering one or two drives. If two drives are entered, you can then place program disk #1 in Drive 1 and the data disk in Drive 2. If only one drive is selected, you must switch the program disk and the data disk as the program requests.

After you have completed the above section you will be asked to input one of the following: review of a tax return, new tax return or print return. If you select "review return," you will be presented with the main menu. You

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will be asked to place an 'X' beside all of the categories you wish to review. The program will then review any of the categories that you have selected.

If you chose "new return," you will again be presented with the main menu and be asked to place an 'X' beside all categories which pertain to your return. After you have selected the categories that best suit your return, the program will interview you in an organized fashion, beginning with the heading information and proceeding step by step through all income, adjustments and deductions, then proceed to compute your taxes. Based on these inputs, the balance due or refund will be computed, very much the way a professional tax preparer or CPA would do.

After all of the information is completed, you will have the option to print your return. The printer function will print all data on government-approved forms. Included in the package are some carrier strips which will enable you to attach non-tractor feed forms so they may be printed.

The program has a unique diagnostic mode built into it. In other words, before the computer writes any information to the disk, it will go into the diagnostic mode to be sure all of the data that was input is correct. If it comes across a piece of information that is not correct, it will give an error code and the user must then go to the appendix of the manual where there is a listing of 94 error codes. The error code will tell you exactly what the problem is and how to correct it. The error must be corrected in order for the program to continue. This measure guards against bad data being input which would produce a bad tax return.

As a reviewer, I make it a habit to call the company offering the software to make sure everything I see is what the customer will receive when purchasing the software. My conversation with Micro Data Systems was not only a pleasure but most enjoyable. Micro Data's main concern is offering fine quality software and excellent product support, meaning that if you have any problems with your software, you can write or call for help and be assured of complete satisfaction. They also assured me that the new package now available has been improved, offering a much better tax preparation program.

In the back of the manual, you will find an order form to order extra forms; also included is a registration form to be filled out and returned so the user will be informed on updates and enhancements. Yearly updates are available for $59.95.

For those of you who have experience with doing tax forms, I think you will find this a masterpiece and a valuable part of your software library. For those of you who do not have any experience in income tax calculating, I feel you owe it to yourself to learn how the right way.

I would like to thank Micro Data Systems for making such a fine and high quality piece of software available for our good old Color Computer. I found it a pleasure to review.

(Micro Data Systems, 6 Edward Drive, Ashland, MA 01721, $149.95)

— Bob Brown

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Sam Sleuth P.I. Is An Extraordinary Case

When I opened the package and saw the game I had received for review, I said, "Golly gee, another Adventure program." But, when I proceeded to read the instructions and load the game, I found out that *Sam Sleuth P.I.* is anything but your usual Adventure game.

Sam Sleuth P.I. is a 32K graphics Adventure program available on disk or cassette tape. One joystick is required.

The scenario is as follows: You are Sam Sleuth, Private Investigator. Your job is to investigate one of three different cases. The case levels and descriptions are described as Novice, Experienced and Expert.

Level 1) Novice — The Case of the Missing Cat: You have been out of work for quite some time. As you sit passing the time away, Shirley Voff, the local school teacher, comes into your office. She wants you to locate a cat she had been asked to watch that is now missing.

Level 2) Experienced — The Mystery at the Museum: The day after you find the cat, you get a call from Rick Anthers, the museum owner. Rick tells you that a valuable statue has been stolen from the museum. He says he had borrowed the statue from another museum and it wasn't insured, which means if Rick doesn't get the statue back, he will have to pay for it. Your job is to find the thief, and the statue.

Level 3) Expert — Baffling Bank Robbery: Rip Voff, the owner of the bank, has heard about the good job you did for his wife, Shirley. He hires you to find the thief who robbed the bank.

One unique feature of this game is that the commands can be entered through a joystick. Commands are entered by positioning a cursor over an icon describing one of the several alternatives at your disposal.

Other features include graphics showing your walk to a telephone booth. You can flip through the pages of the phone book using the joystick. When you get to the number you want, you press the firebutton and it will dial that number. There is even a ring or a busy tone.

Another feature is that you can walk to your car, drive it all over town while you see the car moving through the streets on your screen, and even have a wreck if you're not careful.

I thought the documentation of this game was excellent. The manual tells you everything you need to know about the game, and it even shows you a street map of the whole town with all of the businesses and houses.

I liked this game thoroughly and give it a five out of five stars. It has all the features of a good Adventure, with the bonus of excellent graphics, sound and game-like response while driving your car.

(Computerware, P.O. Box 668, Encinitas, CA 92024, tape $24.95, disk $27.95)

— Pat Downard

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Create Your Own Fashions With *DESIGNER*

DESIGNER is a recent release from the Cognitive Development Company. It is developed for the 32K Color Computer with Extended Color BASIC. With this type of software, it is apparent the Cognitive Development Company is in the business of providing software for young people that will aid in the growth of certain skills and visual perceptions.

DESIGNER is for girls of all ages and teaches not only fashion design, but also teaches computer skills in a non-threatening way. This is of particular value in that concern has been expressed in the educational community regarding the lack of computer use by the female population.

Very simply put, *DESIGNER* is a computer "paper doll." Once the program disk is inserted and run, a color test is given. The program is extrememly friendly and can be used without any fear of messing up anything. The main menu gives you four choices: Design Fashions, Design Fabrics, Check Closet and Finished. You select the choice using the arrow keys and pressing ENTER.

"Design Fashions" is done very simply. You select what style of neckline, sleeve, skirt or pants you desire. You can select one at a time with nine choices given in each category. If you do not like a particular choice, then change it. All selections are shown on the model immediately. When you are finished, you can select fabrics.

There are 26 fabric pages and each page contains eight different fabrics. If you do not like what you see, you can design your own from the main menu. You select fabrics for the top, belt and bottom. Fabric selections include solids, horizontal stripes, vertical stripes, checks, houndstooth, plaids, dots, white patterns and black/white combinations.

After finishing your design, you can store your creation in the "closet." In the "memory closet" there are 12 racks and each rack can hold three fashions. The racks are labeled A-L. As each rack is shown on the screen, you can replace a design, go to the next rack or go back to the main menu. If you do not save your design, it will be lost!

"Designing Fabrics" is the most complicated task in the program. However, the instruction manual is sufficient to lead you through the process. You have 26 design pages with eight patterns on each page for a total of 208 patterns. Any of these patterns can be changed. You do not have to design any fabrics to use the program, but this is a nice option.

The instruction manual suggests various projects: Design fashions for various activities such as swimming, prom date, golfing, day at the office, gardening and school event. Design a wardrobe for a particular person for an entire week, including pajamas and dates. Discover the role and use of fabrics on certain designs by putting the same designs in the same closet with different colors and types of fabrics.

Cognitive Development Company should be congratulated for developing such fine educational software. The graphics are exceptional and the ease of operation is masterful. *DESIGNER* would fit in the library of any home and in the classroom as well. Their motto is very appropriate: "Fun Things for the Mind!"

(Cognitive Development Company, Suite 141, 12345 Lake City Way, NE, Seattle, WA 98125, disk only, $24.95)

— J.D. Ray

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The end-of-line markers are useful for locating run-on spaces at the end of lines and between lines, and for counting spaces between paragraphs. They are essential for the complex on-screen formatting that tables or poetry often involve, as well as for keeping track of carriage returns in program code.

WIZ will run in any CoCo, **16-64K, disk or cassette**. The WIZARD font does not alter the characters produced by your printer.

Details of how the new font is added to Telewriter-64 may be requested when you order WIZ. Previous purchasers may request this information if they include their WIZ ID# and a SASE.

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One-Liner Contest Winner . . .

This one-liner plays "Luke Skywalker's Theme" from the *Star Wars* films.

The listing:

```
0 SOUND 89,10:SOUND 147,7:CLS(4)
:FORX=1TO100:NEXT:RESTORE:FORT=1
TO2:FORL=1TO5:READA,B:SOUNDA,B:N
EXT:RESTORE:FORX=1TO100:NEXT:NEX
T:FORL=1TO4:READA,B:SOUNDA,B:NEX
T:RUN:DATA133,4,125,4,108,4,174,
8,147,9,133,4,125,4,133,4,108,8
```

Richard Davis Jr.
Williston, FL

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape*.)

CoCo Tuner — Fine Tuning With The CoCo

It never ceases to amaze me how the Color Computer takes on more and more tasks. A unique new product came on the market this past December that permits one to use the Color Computer to assist in the tuning of pianos and other stringed instruments. I am not a piano tuner and really not terribly aware of what tuning aids are on the market, but I can assure you that this product is quite simple to use, and it seems to be a very viable way to do the job.

The manual which comes with *CoCo Tuner* is more than adequate, and really quite unnecessary for getting your first taste of what the *CoCo Tuner* can do. Slip in the ROM pack and you have a menu on the screen that lays out all the features. Within a couple of minutes, you can try them and either be bored with the simplicity or pleased with your brilliance in figuring it out all by yourself. At any rate, if you now go beyond the the first two introductory paragraphs in the manual (probably trying to find out what that dancing black line is in the center of the screen) you will find the *CoCo Tuner* is not as simple as it first appears.

The manual is a real gem; it's actually a physics lesson, piano tuning course and program manual all wrapped up in one. Before we get further into its contents, let me quickly review the *CoCo Tuner*'s features. The program causes the computer to sound the notes of the scale at their precise pitch. By pushing the letters 'A' 'B' 'C' 'D' 'E' 'F' 'G,' you can sound the equivalent scale note (beginning with note 'A' which is at the frequency of 220 hertz, for those of you who are technically minded).

When the program starts, you are in octave four (fourth from the bottom of the piano keyboard) and you can change octaves by pushing the zero key. By pushing the up-arrow key or down-arrow key, you can get the sharp and flat notes, or you can continuously push the up-arrow key and proceed through the entire group of octaves. If you sound the 'A' pitch and find it matches none of your black keys or white keys but seems to be somewhere in one of the cracks, there are solutions for that, also.

You can push the 'P' key and adjust the pitch by any given percentage you put in, or you can push the 'H' key and enter the exact number of cycles you want the pitch to have, which would not be any help for piano tuning, but rather is a feature put in for the sound laboratory engineers who have need for a precise frequency of their own choosing.

From a program-function point of view, that's about it, except for that curious dancing black line, which leads us back to the manual and the practical use of the *CoCo Tuner* in the piano-tuning trade. The *CoCo Tuner* ROM pack has a place to insert a high-impedance microphone. By permitting the TV sound being produced by the program to enter the microphone, the black bar in the center of the display should form a stationary pattern. If you turn off the TV sound and try humming the same note into the microphone, you should also be able to cause the black bar to form the same stable pattern.

It is here that the fun begins. If you are flat, the bar slips to the left; it moves to the right if you are sharp. But that is only the beginning; if you sound a note exactly an octave away or harmonically related, the overtones can greatly confuse you in trying to judge if you have the correct stable pattern. This is a case of practice in interpreting the moving bar pattern. Even with my great lack of musical skill, I began to get the hang of it.

Now perhaps you can see the whole picture. By setting the *CoCo Tuner* to a specific note and sounding that note on the piano, you can judge if the piano note has the right pitch by observing the black bar on the screen. The sensitivity and accuracy of the *CoCo Tuner* is really beyond what the human vocal chords can perform and beyond what one would need for any piano-tuning environment.

The limiting factor in sensitivity, for example, is going to be the ambient interference noise rather than a failure to pick up the sound. As the manual says, the pitch accuracy may actually be too great for you when tuning some instruments, such as a guitar, where the bar may move to the right when the string is first plucked and then move to the flat side as the note dies out. This is normal for a guitar sound, but might drive you nuts if you insist on trying to match the *CoCo Tuner* pitch exactly.

What do you want to know about sound or piano tuning? Be it diatonic scales, physics of pianos, theory of tuning, beat frequencies, use of rubber mutes, the art of handling a tuning lever, it is all there in the manual. You are definitely buying a lot more than a computer device when you purchase this product. I found the writing and topics in the manual interesting (even though I probably would never use the information on a practical level).

The *CoCo Tuner* is produced by someone who cares and who knows the field of its intended use quite well.

I tried to get some reaction from professionals in the field. I was concerned professionals might feel that the gimmickry of the *CoCo Tuner* would impinge upon what they thought of as the heart of their professional skills, but this is not the case according to those with whom I spoke. The fairly wide use of strobe-type tuning assistance has already put the profession at ease with sophisticated aids. It would appear there really is a market for a product like the *CoCo Tuner*.

(Real-Time Specialties, Inc., 6384 Crane Road, Ypsilanti, MI 48197, $89)

— Tom Carl

One-Liner Contest Winner . . .

Color BASIC Organ is a musical organ that runs on any version of the CoCo. Just type in a number from '1' to '3,' and when the screen goes blank, bang away at the keyboard. To start over, press SHIFT and CLEAR.

The listing:

```
0 INPUTM:CLS0:FORX=0TO1STEP0:N$=
INKEY$:IFN$="\"THEN0ELSEIFN$=""T
HENNEXTELSEN=INT(ASC(N$)*M):IFN>
255ORN<0THENNEXTELSESOUNDN,1:NEX
T
```

Marc Andreessen
New Lisbon, WI

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape*.)

Zookey Is A Fun And Helpful Typing Tutor

Whether one is an experienced typist or pecks across the keyboard with two fingers, *Zookey*, from Mark Data Products, is an interesting, fun, innovative way to practice typing.

In *Zookey*, Mark Data demonstrates how learning can be fun by teaching typing in the format of a game. Rather than typing about nine million "fff-gggs" to practice, *Zookey* shows you a high resolution screen of animals, cages, keepers and keyboard symbols.

The object of *Zookey* is to type the letter, number or symbol shown at the bottom of the screen in eight columns before the escaping animal gets to the trap door on the screen. If the typist is successful, the keeper scoots up the screen and closes the trap door and the typing score increases. If you are too late, the animal escapes and you lose a key. When all the keys are gone, the game ends.

Zookey provides up to eight skill levels and up to eight speed levels, with your choice of letters, numbers, symbols (punctuation) or a mixture of all characters. The lowest speed and skill levels would be suitable for a beginner and, as an experienced typist, I had a tough time keeping up with the fastest levels.

The high resolution graphics in *Zookey* are colorful, interesting and entertaining. The characters displayed for typing are large and clearly formed, with the exception of some punctuation such as the semi-colon and arrow keys, which can be slightly difficult to decipher immediately. Once you are used to their appearance, however, you can zip right along. One disappointment is that the animals which escape are the same in every instance, rather than being varied. They have the appearance of plump little rabbits with pink cheeks, and as they try to escape, a marching sound is heard over the monitor speaker.

Zookey is much better suited as a tutor than as a teacher for the typist just starting out. If you have some touch-typing experience, the instructions will be very clear and the keyboard finger chart will serve as a helpful reminder. If you are just starting out, there are many bad habits and details of touch-typing that are not listed in the documentation, and I would recommend consulting a touch-typing manual.

Because *Zookey* is in a game format, it is important to limit playing/practice time; the documentation recommends 15 minutes a day, a figure which can help alleviate frustration and boredom. Also, the user should remember that he is competing with himself; "cheating" with finger positions in an effort to achieve a higher score is something to watch out for!

Zookey is enjoyable, easy and fun to use, and most importantly, a very helpful typing tutor. I found that my own typing began to improve very quickly with it. I recommend this program to anyone wishing to improve his or her typing skills.

(Mark Data Products, 24001 Alicia Parkway, #207, Mission Viejo, CA 92691, requires 32K, tape $24.95, disk $27.95)

— Jeffrey S. Parker

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Submitting Material To Rainbow

Contributions to THE RAINBOW are welcome from everyone. We like to run a variety of programs which will be useful/helpful/fun for other CoCo owners.

Program submissions must be on tape or disk and it is best to make several saves, at least one of them in ASCII format. We're sorry, but we do not have time to key in programs. All programs should be supported by some editorial commentary explaining how the program works. Generally, we're much more interested in how your submission works and runs than how you developed it. Programs should be learning experiences.

We do pay for submissions, based on a number of criteria. Those wishing remuneration should *so state* when making submissions.

For the benefit of those who wish more detailed information on making submissions, please send a SASE to: Submissions Editor, THE RAINBOW, P.O. Box 385, Prospect, KY 40059. We will send you some more comprehensive guidelines.

Please do not submit programs or articles currently submitted to another publication.

Centipede ABC's and *123's* Provide Unpressured Learning For Children

At what age can a child be introduced to a computer? When is a good time for a child to start on the road to computer literacy? Triad Pictures Corp. feels that a 2-year-old is capable of using a computer and they have produced two programs for very young children. *Centipede ABC's* is a program for children aged 2 to 10 which deals with the alphabet, and *Centipede 123's* is written for children aged 2 to 6 and uses the numbers one through 20. Both programs require 16K Extended BASIC.

These programs work primarily in the same way except for their main focus. After CLOADing either program, you will be asked to type in the child's name. After this, a skill level will have to be chosen. Each program has three skill levels. Level 1 is a letter or number match; it is really the only level that is appropriate for very young children. Level 2 is for children who are somewhat familiar with letters and letter sequences or number and number sequences. To use Level 3, the child should be very familiar with the alphabet and alphabetizing and counting.

If Level 1 is chosen, the child will see a large letter 'A' (or number 1) displayed in the middle of the screen. The child has to match the large letter to the corresponding key on the computer keyboard. A correct answer will be rewarded with an animated piece of a centipede being added to a smiling centipede face. The object is to build a long, cute bug. An incorrect answer will cause the correct answer to be displayed and the child will be given another chance to answer.

This type of matching exercise is very commonly used as a learning tool for young children. The main flaw here is that the shape of the Hi-Res letters or numbers on the screen is different from those on the keyboard. For children who may not yet recognize their letters and numbers, there is no exact match. My early childhood education experience indicates that for young children doing these matching drills, shapes have to be the same; close doesn't count.

During Level 2 play, the child has to enter the alphabet or numbers in sequence beginning with 'A' or '1'. No hints are given. Level 3 asks the child to insert the missing letter or number between two others. For example, the computer will display 'A' and 'C' with a box between them. The child should type 'B' as the correct answer. In both of these games, a correct answer is rewarded as in Level 1. However, after an incorrect response, the computer will advance to a new question.

Both *Centipede ABC's* and *Centipede 123's* are very low-key kinds of games. They provide an unpressured learning experience for some children and useful review for others, depending on each child's individual level. There is no time limit in the games, so each child can work at his/her own pace.

The routines for correct and incorrect responses are quiet and unobtrusive, but the child can easily distinquish between the two. In no way is he/she ever made to feel badly about an incorrect response. Once the child becomes familiar with using a computer, the programs are easy to use and require little adult supervision.

I became fascinated with the claim that both programs could be used by a 2-year-old, so I invited Heather, a neighbor, to my house. She liked the pictures and pressing the computer keys. However, she had a five minute attention span. Even if she had the knowledge necessary for Level 1 games, they were both much too long. It is too bad, especially in *Centipede 123's*, that the user is not given a choice of parameters. There are more young children who can count to five than can count to 20. The length of the game could be better controlled and the child could get the feeling of finishing something and reaping the rewards.

Along with Heather came Sean, aged 4. The programs were ideal for him and he really enjoyed using them. I went on to observe other children and found these programs are ideal for preschoolers through second graders.

There are, of course, children at both ends of the spectrum that will benefit and enjoy both *Centipede* programs. Individual differences and your child's own ability should always be taken into consideration. Like the centipede in these programs, a child's knowledge will keep on growing.

(Triad Pictures Corp., P.O. Box 1299, 134 Simders Rd., Sequim, WA 98382, both tapes for $25)

— Stephanie Snyder

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Tape . . . $21.95 (16K required) See July '83 review.

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Dan Tucker's Mine Is A Gold Mine Of An Adventure

This text Adventure from Pal Creations is billed as an expert level encounter, and it is! *Dan Tucker's Mine* offers a challenge to anyone who considers himself to be a master at this kind of challenge. There are cabins with locked doors, old sheds, bridges, rivers and more in this program — enough to test the wits of any Adventure buff.

The program is supplied on a high quality cassette and a short, but adequate, instruction sheet is included. The Adventure begins when Dan Tucker's will is read and you find that he has left you his property. Unfortunately, he has left no information on how to find the fortune in gold rumored to be hidden there, so begins a great Adventure.

The program begins with a colorful title screen followed by instructions and a list of available verbs. You have the option of playing with the objects in the same location for every game or you may select randomized placement of the objects for a different challenge. As with most of the more complex Adventures, you must have the right equipment at the right time. This can lead to some retracing of steps to achieve the right combination, but it's all part of the game.

The game is written in Extended Color BASIC for 32K machines and, as supplied, it will not run with the disk controller installed. Listing the first 30 lines revealed the reason for this. The Pal Creations logo on the title page takes enough memory to prevent the use of the disk controller. I was able to delete the logo, save the remaining program to disk and run from disk with no problems. (The logo is a neat piece of work and produces a different color pattern each time, but I don't like to remove my disk controller and can't yet afford a multi-pack interface.)

My only other complaint with this Adventure is not being able to save a game in progress. As difficult as this one is, I really would appreciate the ability to save my progress. I suppose for the price this fault can be excused, as the Adventure itself is what it's all about and this one is cleverly done and runs quickly and smoothly on the screen.

There is a lot of entertainment value packed into *Dan Tucker's Mine*. My 15-year-old son said: "If I was sentenced to life imprisonment and could take only one game, this would be it!"

(Pal Creations, 10456 Amantha Ave., San Diego, CA 92126, 32K ECB, cassette $14.95)

— Charles Bream

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Destroy The Enemy And Don't Get Caught in *Metabot*

Metabot, written by Jay R. Hoggins, is a new strategy game from HARMONYCS Software. The object of the game is to destroy the enemy Metabots by luring them into the electric fences or acid pots randomly placed on the screen by the computer. If you are able to accomplish this, a new screen is drawn and two more Metabots are added to the number needed to advance to the next screen.

Upon `CLOADM`ing and `EXEC`uting the program, the player is greeted with a title page and a four-part harmony rendition of "Darth Vader's Theme" from *Star Wars*. The computer then asks if you need instructions; if you reply "yes," the title screen disappears and a new screen is drawn with a little poem which gives the general object of the game. Pressing any key will cause the program to ask the player to type in his name of up to nine letters. The program next asks the player which of the three levels he wishes to attempt. Once all this preliminary information is entered, the game begins.

The computer draws the game board, printing your name in the lower left corner, and a diagram of the keyboard layout you are to use to move your player around the grid is displayed in the lower right corner. Your player can move in eight directions, controlled by pressing the 'U,' 'I,' 'O,' 'J,' 'M,' comma and period keys. The game board consists of the electric fences, the acid pots, your player and the Metabots.

To destroy the Metabots, the player must move around the board trying to make the enemies run into the fences or pots without the player running into the obstacles.

If you move your player within three seconds of the start of the game, you will receive the optimum amount of points for each robot destroyed for that level. Otherwise, the value for the destroyed robots is decreased 10 points for moves taking between three and 10 seconds, and then 20 points for moves taking beyond 10 seconds. Every time your player moves one space, all the enemy robots move one space, continually stalking your player.

Destroying all the Metabots takes you to the next screen, but if one should touch your player or should you run into a pot or fence, the game is over and your position on the high score list is displayed.

There is an old proverb that states,"You can't judge a book by its cover." If I had just read the instructions to this game and had not seen the program itself, I would have envisioned the game to have a little man running around the screen, dodging these big robots and watching out for the electric fences. But, what you get is a flashing dot, similar in shape to a cursor, representing your player. The deadly Metabots are multicolored blocks the same size as your player. The pots and fences are solid blocks, again the same size as your player.

On Page 153 of the December 1984 issue of THE RAINBOW, one can get a fairly accurate picture of the program in the advertisement for the game. One might argue that a strategy game (what this program claims to be) does not require great graphics, just something to aid the player in determining his next moves. I don't agree with this because if I'm to pay up to $21 for a game, I expect graphics the CoCo is capable of, not something that looks like it came off the TRS-80 Model 4. To say the least, I was disappointed with the graphics in *Metabot*.

Even with sub-par graphics, a game can be good if it is fun to play. Again, I believe *Metabot* falls short in this area. The basic problem with this game is that it is too easy. The Metabots have virtually no intelligence; they just move until they are lined up with your player and then just follow your every move no matter where it takes them.

The three levels of play don't significantly alter the difficulty of the game. When you do clear the screen of all the Metabots, your reward is nothing but a little message written on the top of the screen.

The sound effects aren't as exciting as the documentation claims, just "beeps," although the music at the start of the game sounds pretty good. The documentation supplied with the program is very comprehensive for a game, but I did find some typos within its six small pages, maybe signifying that the program was rushed out on the market too quickly.

If you don't mind paying up to $21 for an easy strategy game, then this game is for you, but frankly, I don't think the program is worth the price. *Metabot* may have a problem finding a specific age audience because the younger set will become uninterested with the lack of good graphics, sound and incentive to continue on destroying *Metabots*, while older players, who might be able to forgive the game for these points, will find the game too simple.

(HARMONYCS, 1747 Patricia Lane, Salt Lake City, Utah 84116, cassette $18.95, disk $20.95)

— Ken Coleman

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Recess Games Encourages Logical Thought Processes

Recess, in my day, meant running out to the schoolyard and playing with the equipment there. When it rained, we usually went to the school gym. Times have changed, if B-5 Software's title, *Recess Games*, is taken literally. What we have here is a group of four computerized games which provide a break from more formal learning, but all of which improve a child's use of logic, not a group of games for outdoor use.

The disk version loads a title screen and a menu from which the individual games are selected, while in the tape version each game is loaded individually. From the instructions, I infer that is the only difference between the two.

In *Treasure Hunt*, the object is to find a treasure chest concealed beneath one of the squares on a 10 by 10 grid. Horizontally the grid is labeled with red letters, vertically with green letters. Squares are chosen by specifying the coordinate letters. To the right of the grid is a thermometer which indicates how close your selection is to the goal; the higher the temperature, the closer you are.

As squares are selected they become chess pawns, until the square with the chest is found. Then a small chest is seen in that square; the screen clears and a large treasure chest fills the screen.

This game provides an excellent introduction to the use of coordinates, but has one puzzling peculiarity. When the game initializes, most of the squares are blue, but some, apparently at random, have pictures on them. Everyone (child and adult) who tried this game immediately wanted to know what the pictures were for, but no one could think of a reason for their presence.

Master Brain is a computerized version of "Mastermind," in which numbers are to be guessed. The player selects the size of the number to be guessed, from two to four digits, and the range of digits to be used, with a maximum of 10, using zero through nine. The number chosen as the guess is on the left, and on the right are two columns, labeled right and wrong. If a zero is placed in the right column, one number guessed is in the puzzle and in the right place. If an 'X' is in the wrong column, one number is in the puzzle but in the wrong place. If nothing appears in either column, all numbers used in the guess are incorrect.

The screen display is good and clear. However, it allows for the display of only 12 guesses and no provision is made for scrolling earlier choices off the screen, so the player has only 12 chances for each puzzle. The instructions advise beginners to start with a few digits and then go to the more advanced levels. Although this is good advice, a very common comment heard during testing was "I almost had it figured out." For children learning to play such logic games, it is better to allow them as many chances as they need for success rather than to establish arbitrary limits which lead to frustration.

Number Guess is a good version of the old favorite, which allows the player to select the range of numbers in which the number is found, and the screen shows if the guess is too high or too low. Unlike *Master Brain*, there is scrolling so the child can see the last eight guesses made and continue until successful.

The fourth game is a nice version of *Tic-Tac-Toe* for one or two players, which uses the arrow keys to move the X's and O's.

On the whole, these are colorful, well-presented games that are fun to play and at the same time encourage logical thought processes. The accompanying booklet gives clear instructions for game play and includes some suggested learning activities.

(B-5 Software Co., 1024 Bainbridge Place, Columbus, OH 43228, tape requires 16K ECB, $19.95; disk requires 32K ECB, $21.95.)

— Carol Kueppers

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Test Your Command Strategies With *Debacle*

Debacle is a historical Simulation of the 1755 battle involving a French garrison and their Indian allies at Fort Duquesne against a vastly superior British force. The Simulation's name is derived from the overwhelming defeat the British suffered even though they outnumbered their adversaries nearly four to one.

The game requires 32K of Extended Color BASIC and has two copies on tape but can easily be transferred to disk. The eight-page instruction manual is very attractive and professionally printed on heavy parchment-type paper analogous with the game's time frame. Furthermore, the first two pages of the manual are a detailed reflection on the historical nature of the battle. These two factors effectively establish the game's mood once the Simulation is `CLOADed` (which takes a little over two minutes) and run.

Upon running, there are various user responses required. These include whether the high-speed `POKE` is usable on your particular computer, whether it is a new or continued game (the program reads and saves the game to disk if a disk drive is attached; otherwise, it is saved to tape) and what skill level is desired (level 1 is a practice session for game familiarization, up to level 5, which is an accurate representation of the actual battle).

The title page graphics are relatively simple and it plays several short classical tunes which are apropos to *Debacle*'s setting. This musical interlude is rather lengthy, but apparently permits CoCo to draw the playing field map. However, do not let this simplistic graphics title page deceive you; this is a very sophisticated Simulation which belies its introductory sequence.

The playing field map consists of forest areas, mountains and streams which you, as commander, must navigate from the lower right of the monitor screen to the upper left where Fort Duquesne is located. Other factors hampering your march are a time factor, Indian attacks, and supplying your combat units.

You commence your march on May 29 with four combat units and one supply unit under the command of Dunbar. Their initial task is to clear the forested areas so when the major force of Halket, Ranger, Artillery and Supply arrive on June 9, they will have an easier time of marching to the main destination of Fort Duquesne. Since there are numerous Indian attacks enroute, it behooves you to lessen their numbers by searching and capturing their camps in the woods. The more Indian camps captured, the fewer Indians there are to assist the French in defending the fort. Capturing the Indians is best accomplished by the Rangers since they have the best maneuverability.

A recurring situation you must cope with is keeping the combat units adequately supplied because they become immobile once their supplies are exhausted. However, the supply units are the least maneuverable of all the units; therefore, a carefully orchestrated method of supply is necessitated, especially since your battle plan must be completed no later than July 17.

Selecting which unit to move is performed by a polling cursor routine which shows the unit's identity, their current strength, the number of days of supplies on hand, and the number of moves available. It is essential that you know which unit you wish to move because once you key in the movement code, it is too late to change your mind; that unit must be moved.

Even though this war Simulation is relatively short in its playing time (two to three hours), it requires intense concentration and an effective method of attack to succeed at winning. Part of the enjoyment in a game like this is discovering the various scenarios that may be utilized to ascertain the most effective strategy, so I will avoid giving any specific tips, however, a few general words of advice are to make sure all combat units are well supplied before reaching the fort, try to capture as many Indian camps as possible and determine an efficient means of crossing the mountains.

Once *Debacle* is completed, the computer critiques your battle plan and lists statistics concerning the battle. After you have digested this data and are ready to play again, you must press Reset to exit the statistic screen.

A few problems I incurred primarily concerned trying to save or load games in progress. Upon loading a saved game from tape, I received an I/O Error in Line 363. On another occasion, I received an FD Error (bad file data) in Line 364. According to the author, there are three saves made on tape but I could not get any of them to load.

When trying to save a game on disk, I received an SN Error in Line 508. According to the author, this was a common problem when he and associates play-tested the game. This problem varies from computer to computer and is caused by either having or not having a space between the `WRITE` and # codes in lines 508, 510, 512, 514, 516 and 518. After careful consideration, the author decided to omit the spaces in these lines. Once I made these changes, I was pleased to find that disk saves/loads were easily accomplished.

A final problem I encountered concerned the polling cursor routine. On two separate occasions, once at level 1 and once at level 5, the routine unexpectedly hung up, preventing any input whatsoever. This was particularly frustrating after playing a game for nearly two hours. Numerous conversations between the author and me failed to resolve the problem and it finally appeared to be a genuine bug in the program. The author is currently attempting to resolve the bug and may have it done by the time this review is published. I was genuinely impressed with the author's concern in attempting to make the game 100 percent operational and his historical knowledge.

If you enjoy war Simulations, you will find *Debacle* testing your best command strategies.

(Picosoft Games, P.O. Box 35, Eighty Four, PA 15330, tape $24.95, Pennsylvania residents add 6% tax)

— Dan Smith

Clip Surge Spikes With Electra-Guard

Several weeks ago I received Electra-Guard, the SS-1 Surge Suppressor, for review. My first reaction was panic. How was I going to check out the surge suppressor? There was no way I was going to induce voltage or current surges into my equipment. I decided on an alternative to actual surge testing, running Electra-Guard under various loads.

Electra-Guard was tested on a large variety of equipment, everything from video recorders to complete computer setups. Normally, I had a six-outlet power strip plugged into the surge suppressor. All the equipment operated properly.

The specification data included with Electra-Guard was a little skimpy for a review. I called Howard Medical, the manufacturer, for more information. I placed the call at 8 p.m. (Chicago time), and there was someone on duty to answer my questions. I talked to Ross Litton, and he gave me the information I needed. Electra-Guard can handle 15 amps of current and works on 115 VAC house power. The response time of the surge suppressor is five billionths of a second. Surge spikes of 6000 volts will be clipped to 240 volts.

There is a red windowcator on Electra-Guard. If the windowcator turns black, return Electra-Guard to Howard Medical. The black color indicates the surge suppressor has been hit by a very large surge. I was told that Electra-Guard has a five year warranty.

From my research, I discovered that you can put a six-outlet power strip, with power indicator, on/off switch and circuit breaker together with Electra-Guard for about $35. I found one thing missing that I like to see on electrical devices: a UL number. According to the package I received, Electra-Guard was not tested by Underwriters Laboratory. I think products of this type should be tested by an independent laboratory.

(Howard Medical, P.O. Box 2, Chicago, IL 60690, all CoCo equipment, $16.25 plus $2.00 S/H)

— Gabe Weaver

YACHTSEE Can Make Dice-Rolling Addictive

In our rush to find uses for our computer, we sometimes overdo it. If I write only five checks a month, a check balancing program is probably unnecessary. If my taxes only require the short form, I'm probably wasting money and time if I purchase income tax software. Twenty phonograph records or 10 recipes do not usually justify a database program.

The same goes for games. A game that is simple, fast and enjoyable is not necessarily improved by playing it on the computer. Such is the case with *YACHTSEE* by Beargrip Software.

The original non-computer game which this game is based on is played with five dice and a scoresheet. Players take turns rolling and rerolling the dice trying to make certain combinations. Points are scored and the game ends when the various categories are filled. Despite the randomness of the dice roll, there is some skill involved in winning. The game is fast and fun, and sometimes even addictive.

YACHTSEE uses the Color Computer to roll the dice and keep score for up to six players. The game's graphics are good and the scorekeeping is correct and helpful, but the game simply moves too slowly. The slowdown occurs while waiting for the game to ask if you wish to roll again and then which dice you will reroll. The program is written in BASIC and the slowness clearly affects the game's playability.

THE RAINBOW's guidelines for reviewers asks us to let the product stand on its own. Even if you have never played the original dice game, I think you will find the game's pace is just not fast enough. If you have played the original, you'll probably want to stick with it — some things are just not improved by putting them on a computer.

(Beargrip Software, distributed by Softmart, P.O. Box 61095, Raleigh, NC 27661, 32K ECB, tape $16.95, disk $17.95)

— John Matviko

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ME-128-64 128K Upgrade Expands CoCo's Memory

Many of us old timers can remember when we only had 4K. Then came 16, 32 and now 64K. I used to think this was the limit to my CoCo's memory. Recently, my ideas of the CoCo's ability have been expanded by the introduction of the ME-128-64 128K Upgrade from Dynamic Electronics.

This upgrade comes with all the parts needed. The only tools needed are a screwdriver to open up your CoCo's case. I also used an IC extracter/inserter to help me, but a small flat blade screwdriver should also work. The upgrade consists of 10 ICs, installation instructions, a small user's guide and a copy of Dynamic's catalog.

The installation was fairly simple because all the soldering has already been done for you by Dynamic. To do the upgrade, you first open the cover of your CoCo. A word of advice at this point: as you loosen each screw, place a piece of tape over the screw hole. This way, when you turn the CoCo right side up, you don't have to worry about where the little parts have gone in your shag rug.

After the cover is off, you must remove your RF shield. Then, you remove your eight 4164 memory chips from their sockets and put them aside. The same is done with the 6883 SAM chip and the 6822 or 6823 PIA chip #U18, for 'F' boards, or U8 for 'D' or 'E' boards. (My documentation did not say what chip it was in the CoCo 2. I also suspect those of you who have the new CoCo 2 with the new SAM chip and only two memory chips will not be able to use this upgrade.)

After the old chips are out, put the new chip/socket combos back in their place. At this time, you can check to see if these new chips are working. After this, put your original chips back in the sockets on top of the new chips. It will remind you of the old "piggyback" upgrades as each memory socket, the SAM chip and one of your PIAs now has two chips plugged with one on top of the other.

A small hole should be drilled in your CoCo's case to hold the small toggle switch that switches between your two banks of memory. Replace the cover on the CoCo, tighten the cover screws (wasn't the tape a great idea?) and you are done.

Use of your two banks of 64K can be controlled by hardware or by software. Two simple pokes switch you between banks or you can use the switch to do it manually. In effect, you now have two 64K computers in one.

You can use either bank you wish but there is a catch. Because you have only one CPU and VDG, you must be doing similar things in both banks or these chips will get confused. You can run two BASIC programs if, when you switch banks, you are in the text mode.

You can also run any two copies of a heavy graphics program. For example, I edited two documents with my word processor at the same time. I switched the switch and the document on the screen changed. I also was able to run two copies of an arcade game. By doing this, two sets of high scores can be kept going at the same time.

One fault I found was the claim that you could pass variables between banks. The instructions contained no indication of how this could be done. A call to Dynamic (they were open on a Saturday!) cleared it up. You can pass a zero through 128 integer value between banks from BASIC. To do this, you take the value you want to pass, multiply it by two and POKE it in memory address 65321. The receiving bank PEEKs that address and divides it by two. The multiplying and dividing is needed because you are actually storing a value in a PIA register which masks out bit zero when it does the switch. I was told this information would be included in future editions of their instructions.

One other problem I had was with overheating the SAM chip. With two SAMs stacked on top of each other, heat can build up after three or four hours. The overheating of the SAM chip will make your computer lose track of where memory is and what's in it. I found pieces of my text wandering around my review as I typed it in. One of the small fans you can buy should cure this. Possibly a heat sink could be built into the kit by Dynamic, also.

Overall, I found this to be an easy-to-install upgrade that performed exactly as is advertised. What I would like to see now is more software that could take advantage of the extra 64K. How about a 64K RAM disk? Dynamic has shown us what could be the next step in the continuing evolution of the CoCo.

Dr. Megabyte salutes the pioneers who blaze a new trail of CoCo power for the rest of us. For those of you who want to follow right behind these pioneers, I recommend the ME-128-64 128K Upgrade from Dynamic Electronics.

(Dynamic Electronics Inc., P.O. Box 896, Hartselle, AL 35640, $129.)

— Mark E. Sunderlin

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The Shadow Lurks In Action-Packed *Shamus*

He's here all right. You could tell from the moment you entered. This is just the type of place the "Shadow" loves — dark, dreary, dangerous and deadly. Deadly, at least, for you. The Shadow's Lair has the most modern intruder-exterminating system in the known galaxy. Robo-Droids patrol the corridors, programmed to destroy you at any cost. Whirling Drones home in on your every move and Snap-Jumpers snap in and out of your time-space continuum appearing first in front, then in back of you, or worse, *on* you.

And, as if his creatures were not enough to dispose of you, the Shadow has electrified the walls. Of course, your every move is monitored by the big man himself, who at any moment might appear on the scene, covered in his impregnable Tri-Gamma armor.

But you are the "Shamus," and the word "quit" is most decidedly absent from your vocabulary. Armed with your Ion-Shivs, which you can fire in any one of eight directions, you have vowed to kill this shady Shadow character if it's the last thing you do! But it won't be easy . . . you knew that from the start.

The Shadow has built a four-level, 148-room complex. You must traverse the treacherous maze-like passageways in search of the keys which will allow you to advance to the deeper levels of this dungeon, for it is only in the deepest recesses of Level 3 that you have a chance to annihilate your nemesis.

Thus begins the game of *Shamus*, one of Radio Shack's latest disk-based game programs. *Shamus* itself is not a new game. It was released about a year ago by Synapse Software, which has since ceased marketing CoCo software. The game is fun, action-packed and is well thought out, but the real question in any game review is not "Is the game good?", rather, "With all the other games available for the CoCo, is this game worth spending money on?" Read on for the answer.

To load *Shamus*, insert one of the two copy-protected disks which Tandy supplies into the drive and type `RUN"SHAMUS"`. After a few seconds, a title screen will appear, accompanied by some very good music. The game will then give you the option of changing the skill level from Novice to either Advanced or Expert. One of the novel features here is that changing the skill level affects only one thing in the game — the speed. In fact, at the Expert level, I'd say it is one of the fastest CoCo games you could buy.

Shamus is a "shoot-'em-up" game. It doesn't pretend to be much else. Rather, it makes the most of what it is. The graphics are good, animation smooth and sound effects adequate. Joystick response is good, even from the old Radio Shack ones.

And addicting it is. One of the elements which makes the game even more addictive is that unlike many shoot-'em-ups, *Shamus* never really ends until you defeat the Shadow, a task which is not easily accomplished (I have yet to reach Level 3!). The game doesn't just end; instead, your quest continues and your desire to crush the Shadow intensifies.

All of which brings us to the real point in this review — is *Shamus* worth $30? If you abhor shoot-'em-ups, or would prefer strategy games, perhaps not. But if a fun-filled game which is 98 percent pure action is what you yearn for, I'd be hard pressed to recommend a better game.

(Radio Shack Stores nationwide, 16K, disk $29.95, Catalog No. 26-3289)

— Eric Tilenius

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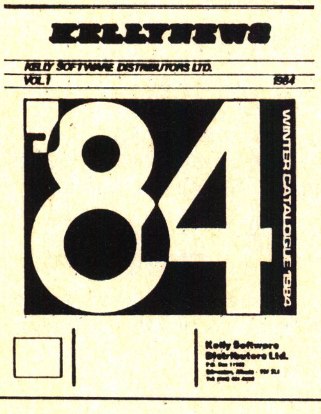
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One-Liner Contest Winner . . .

Barry Becker says, "My entry is called *Blobs*. Big deal." Try it and see what he means.

The listing:

```
0 PMODE4:SCREEN1,1:PCLS5:X=RND(-
TIMER):FORK=1TO1E9:X=40+RND(175)
:Y=40+RND(111):N=RND(40):C=RND(2
)-1:FORJ=1TON:CIRCLE(X,Y),J,C:NE
XTJ:C=C+1:CIRCLE(X,Y),J,C:NEXTK'
************* BLOBS *************
****** BY BARRY E. BECKER ******
```

Barry Becker
Smithtown, NY

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape*.)

Software Review

PANZERS EAST! Gives Many Hours Of War Game Competition

The date: June 22, 1942. The time: 3 a.m. You have been given sole responsibility for Operation Barbarossa, the Nazi plan for the invasion and destruction of the Soviet empire. At your disposal are over 400 divisions as well as the might of the Luftwaffe. Your opponents are a defending army about 25 percent larger than your own, the vast distances of the Soviet steppes, and time — time for the Soviets to dig in, time for their rearmament and recovery from your surprise attack, and time that will bring the bitter Russian winter; the same winter that crushed Napoleon and would force a halt of your offensive for months, depriving you of the momentum of the attack and allowing the Soviets to rebuild for a counterattack. It's time now to order *PANZERS EAST!*.

Game components are limited to the cassette (which has a Commodore 64 version on side one and Radio Shack versions I/III/4 followed by the CoCo version on side two), a clearly written 12-page instruction booklet and a small, attractive map of the Western Soviet Union. The map is necessary as (unfortunately) no graphics are used in the program.

As with another Avalon Hill game for the CoCo (*MIDWAY*) the CoCo version of *PANZERS EAST!* has extra options not included in the versions for the other systems. These allow the player to check the geographic regions of greatest importance to final victory, or order up a standard Combat Air Patrol for selected areas. Both make for easier and faster play.

My trusty 'E' board is willing to ignore cassette programs for the models I/III/4, so it was possible to avoid fiddling with earphone and microphone jacks when loading by 1) going fast forward to the end of side one, 2) flipping the tape, 3) typing `POKE25,6`, and 4) `CLOAD`. Now go and prepare a hearty snack: two sandwiches and a glass of milk should do. Don't rush. When all is "OK" type `RUN`.

The playing time is given as one to three hours. Except for my first two games (in which the CoCo beat me solidly in under 90 minutes each time), I found playing times to run from five to seven hours. Be sure you have a comfortable location as you are likely to be pinned down for some time. This may be a personal problem, though, as I find playing times longer than listed with most strategy games I've played.

After typing `RUN` and the Avalon Hill logo leaves the screen, you are asked if this is a new game or one in progress. If a continuing game, you now place the cassette with the previously saved data file in the cassette player, press Play and continue. A new game requires further decisions of playing a historical game or a very slightly shortened version which gives one week of better weather and a few more ready units at the start.

Next, you set the importance of general campaign objectives — capture of population centers, industry, agricultural areas, isolating the Soviet Union and maintenance of Allied good will. These are key decisions

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as this information is used to generate a list of areas with moderate to high victory point values, so you must set your military objectives for the game. Avoiding the main objectives can lead to being relieved of command or more often the firing squad (a bit drastic I thought).

The last choice to make (we are still in pre-game set up) is what percentage of the Luftwaffe to throw against the Soviet air force. (I suggest a full 100 percent as anything less risks the survival of a significant portion of Russian air power and to provide effective support requires at least one-third of the available aircraft.) A strong first strike leaves the Soviets with about 10 percent of German air strength; unless checked, this will build as the game progresses.

At the start of each turn, except the first, you must decide which single area will receive supply priority. It is critical that attacking units be kept in supply, as poor supply can reduce effective strength by 75 percent! Many times this will call for a difficult choice as several areas may be in combat or open to counterattack, and each may be in need of resupply. The greater the number of areas you occupy, the greater the difficulty in supply and danger of counterattack.

The key to playing *PANZERS EAST!* is keeping track of both Soviet and German troop strengths and locations. This data can be taken from the "review troops" command and the "intelligence" command. To provide an easily readable record of the situation, I found it helpful to use self-made counters representing either 20 or 50 units to be placed on the map provided with the game. These are updated each turn, allowing a close watch to be kept on a gradual Soviet buildup and also ensure you know your own strong and weak points.

The Luftwaffe is available for Combat Air Patrol (CAP), Bomber Escort, Ground Attack (straffing) and Bombing Missions. From about turn three on, be sure to assign CAP to all areas in which you have troops. Also, some long range CAP to go with bombers and escorting fighters often brings in a bonus of extra downed Soviet aircraft. A CAP of three or four over rear areas is generally enough, while four to seven over your main troop concentrations might be called for late in the game (when they are most difficult to spare).

Use the Luftwaffe as a disrupting force against Soviet troop buildups and in support of attacking troops. It appears that straffing does little damage while incurring relatively heavy losses. Don't be concerned about transferring air assets from one operational zone to another. Air power should largely follow the troops.

PANZERS EAST! touches many problems from air power to partisans (they attack weakly-held areas) to weather, even Allied troops who refuse to move beyond their limited zones of responsibility. A game save feature even allows the saving of a game at a given point, so it may be played again from that point to fine tune strategies — an interesting technique to apply if you want to win a particular game at all costs!

For those of you with an interest in the eastern front war, or any wide scale conflict involving the military aspects of expansion and occupation, *PANZERS EAST!* will give many evenings of competition. Avalon Hill has provided another welcome addition for your war game collection.

(The Avalon Hill Game Company, 4517 Harford Road, Baltimore, MD 21214, 32K ECB, tape $25)

— Nevin J. Templin

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KRT Software Inc.
P. O. Box 41395
St. Petersburg, Florida 33743

One-Liner Contest Winner . . .

This one-liner is a "micro" tutorial in using variables in DRAW and PLAY.

The listing:

```
1 PMODE4,1:PCLS:SCREEN1,1:PMODE3
:X=RND(200):Z=RND(200):Y=RND(100
):S=RND(100):X1=RND(15):X2=RND(2
5):DRAW"BM=X;,=Y;R=X2;D=X1;L=X2;
U=X1;":PAINT(X+1,Y+1),2,4:CIRCLE
(Z,S),X2:PAINT(Z,S),2,4:LINE(X,Y
)-(Z,S),PSET:PLAY"L=X1;A;L=X2;B"
:GOTO1
```

Jo Ann Karaffa
Wilmerding, PA

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape*.)

Youngsters Can Enjoy *Tic-Tac-Toe* With CoCo

The classic game of "Tic-Tac-Toe" is certainly one of the earliest board games a young child learns to play. This cassette-based version, for the 16K Extended BASIC Color Computer, is definitely more enjoyable than the version typically played on paper.

Loading instructions are on the cassette label and the program loads in approximately 60 seconds with no problem at all. Upon running, there is a title page and a high speed 'X' and 'O' traveling across the screen. These two alpha characters generate tones that with a little imagination sound like their pronunciation.

The operating instructions are complete and easy to understand. Game options include: A) If there are two players or if you are playing against the computer; B) If you want to be 'X' or 'O'; C) If you would rather use joysticks or the arrow keys; D) The number of games per match (one to five); and E) The level of play (this is for playing against the computer only and includes beginner, average, or impossible-to-beat levels).

Since this game appears to be for a child who is a novice to *Tic-Tac-Toe*, I am surprised there are no instructions whatsoever on how to play the game itself.

The graphics are very colorful and easily legible for young eyes while most of the sound effects are pleasurable enough. Even though my 16-month-old son is much too young to comprehend the game's concept, he enjoyed viewing the screen and listening to the audio.

Playing against the computer, I found it pleasing to discover that it did not make moves that were obviously incorrect. Even though most of the games were draws, the computer can be beaten in the first two levels of play by using the classic "Two-Ways-To-Win" scenario.

By using this strategy, the computer gives a surprising message (I won't tell you what it is); a nice touch. On the impossible-to-beat level, it lives up to its name; after playing at least a half hour, every game resulted in a draw.

However, this version of the game is not a total bed of roses; there are some thorns. The problem areas are threefold; one major, one minor, and one irritating.

The major problem is that in playing against the computer, while using the arrow keys, the computer quite often (approximately 75 percent of the time) automatically gave me the key center block without having me supply any input. This occurred regardless of whether or not I had the first move. The minor problem is that in games where seven or eight blocks are filled and there is no possible way for either opponent to win, the game must be finished with all blocks filled to its inevitable conclusion of a draw. The irritating problem again concerns playing against the computer. After winning a match, I was given a "razzing" tone; certainly poor sportsmanship by my electronic adversary.

Nevertheless, the youngster who is having his first exposure to *Tic-Tac-Toe* should find the game enjoyable and at only $4.95, well worth the expenditure.

(Draco Software, 22 Lassell St., Portland, ME 04102, $4.95)

— Dan Smith

One-Liner Contest Winner . . .

This program will turn your CoCo into an alarm system to guard against any little "door-slammer" who may want to bang on those keys if you have to leave the room. Just turn up the TV volume and wait.

The listing:

```
10 A$=INKEY$:IFA$=""THEN10ELSEFO
RX=1TO5:Y=RND(8):CLSY:SOUND150,8
:PRINT@224,"DO NOT TOUCH THOSE K
EYS AGAIN !!":FORT=1TO100:NEXT:S
OUND180,8:FORT=1TO100:NEXTT,X:CL
S:GOTO10
```

Tom McCarthy
Sterling, VA

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape*.)

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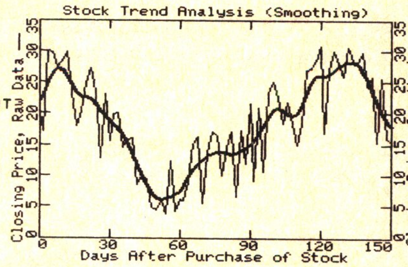

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Software Review

Go On An 'Eeblewalker' Hunt With *LINER*

Software documentation can be misleading. A perfect example is the documentation/directions I received with a program called *LINER*, by Michael Stuller. *LINER* needs at least a 16K ECB CoCo and comes on cassette. The documentation is quite adequate, but misleading.

The background tells of a strange, rectangular planet called Oktry, which is inhabited by Eeblewalkers. You, being an Oktrite, make your living by hunting Eeblewalkers. It goes on to say that as you move about the planet, you dig a trench, which if fallen into, will cause you to tumble to your death.

After reading the background, I had visions of neat little graphics creatures running around on Oktry with me chasing them as I was digging trenches. *LINER* is simply a green screen with a rectangular border which has about 15 randomly placed blue squares (what you get if you `PSET` in `PMODE 1,1`). A yellow line from the left side of the screen starts to move to the right. Using the arrow keys, you guide the line across the blue squares, "killing" the Eeblewalkers.

If your path crosses the "trench," you die and lose one of your three lives. If you successfully "kill" all the blue squares, another screen full of squares will appear. Five points are scored for each square you destroy, plus a bonus for each screen you complete.

I found *LINER* to be boring, but decided that it deserved a second opinion. I sat my 8- and 12-year-olds down and had them play. Both lost interest in about five minutes.

To sum up this review, my conscience won't allow me to say anything other than don't waste your money on this one.

(Michael Stuller, 2 Audubon Place, Rolla, MO 65401, 16K ECB, cassette $7.95 plus $1.50 S/H)

— Paul Austin

Hardware Review

Triple Joyport Switcher Saves Wear and Tear On Your CoCo

The Triple Joyport Switcher from Spectrum Projects is a nice accessory for those of us who use more than one product that plugs into the joystick ports. Imagine the wasted time, worn out plugs and worn out fingers used to switch between one type of joystick to another.

For instance, suppose a person is an artist, game player and aviation expert. There is a specially built joystick assembly for the popular graphics program, another contraption for some of the flight simulators and the run of the mill joystick for "normal" games. Just having to switch plugs every time he/she changes programs is anything but pleasant. Spectrum Projects also knows that; that's why they have come up with the Joyport Switcher.

First, a description of the switcher. It comes in a generic experimenter's box slightly larger than a deluxe joystick. Running from the back are four cables: three for the different joysticks and one to be plugged into the computer. All you have to do is plug the three cables (or less if you don't wish to use all of them) into the accessories, and the fourth one into the joystick port in back of the computer. After that, all you have to do is turn a knob to select which one you wish to use.

Although the box is not very decorative, it is very well-constructed and looks "distinguished." The purpose of the switcher is not to be attractive, but to save wear and tear on the user and the computer, of which it does an excellent job. If you ever find yourself unplugging one joystick to use another one, you probably will be grateful for this product.

(Spectrum Projects, Inc., P.O. Box 21272, 93-15 86th Drive, Woodhaven, NY 11421, $39.95 plus $3 S/H)

— Jim Sewell

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CoCo Max Delivers An Outstanding Performance

By Jesse W. Jackson and David L. Tate

CoCo Max is a sophisticated graphics system that can be used to generate, process and edit graphics pictures with a single joystick, mouse or touch pad. The program is a nearly perfect clone of the Macintosh's *Macpaint* program. In fact, we put Mac and CoCo side by side to compare the two, but we'll get to that later in this review.

The disk version comes with a non-copy-protected diskette, a program-pak and a 39-page user's manual. The diskette contains the *CoCo Max* system, several pictures, and a BASIC program to configure the system for various printer models and Baud rates. The program-pak contains a high resolution A/D (analog-to-digital) converter with a DIN connector for plugging in any device, such as a joystick, mouse or touch pad, that can be used on CoCo's joystick inputs.

My diskette contained machine language drivers for Gemini-10X/15X, Epson MX and RX, DMP-100, DMP-200, DMP-400 and C. Itoh printers. I had to modify the Gemini driver for my Gemini 10 because of differences between the 10X/15X and 10/15 in graphics mode. The Epson MX driver worked well on an EPSON FX-100 the first time.

The program-pak is well-constructed and has the same size and appearance of a Radio Shack cartridge. The DIN connector for the joystick input is flush, mounted at the end of the cartridge for a firm fit. This cartridge contains no program ROM, but an eight channel, eight-bit A/D for accessing any of the 256 possible horizontal pixels and the 192 vertical pixels in the work area.

This program-pak is needed to optimize *CoCo Max*'s performance because CoCo's six-bit A/D limits access to 64 pixels in each direction at any one time. CoCo's A/D could be scaled by software but at a loss of resolution (the cursor steps would be every fourth pixel). A sliding window could be used at the expense of the response time (the joystick could access every pixel in a 64 by 64 movable area and this would require extra processing time).

The user's manual is comprehensive, complete with illustrations and well-organized. You will want to read it carefully to discover the full capabilities of *CoCo Max*, such as menu shortcuts and using the SHIFT for special effects.

Description

First of all, you should look at Colorware's advertisement in this issue to visualize how the program presents the menu and graphics pictures. Secondly, let's define some terms. "Icons" are pictures symbolic of the function to be performed. "Pointing" will be defined as positioning the program's cursor or arrow pointer with the input device (joystick, mouse or touch pad). "Clicking" means pressing that device's firebutton. "Dragging" is holding the firebutton down while moving the joystick.

CoCo Max is operated by POINTing and CLICKing. The only typing you must do is to enter the filename you wish to `LOAD` or `SAVE`. You can insert text into the picture from the keyboard in several fonts and styles. The SHIFT key can be used for special effects, and supplements the firebutton.

You create a picture by selecting tools from the icons in the tool kit and using them within the work area.

When you have selected a tool, the cursor becomes the icon of the tool while in the picture area and is an arrow pointer in the menu, tool or pattern area. The tool kit contains a lasso, editing box, hand, alphanumeric set, paint can, spray can, paint brush, pencil, rubber band line, eraser, rectangle, rectangle with fill, rounded rectangle, rounded rectangle with fill, circle ellipse, circle/ellipse with fill, free-hand shape, free-hand shape with fill, polygon and polygon with fill.

The brush, paint can, spray can, rubber band line and fill tools paint in one of 60 selectable patterns at the bottom of the page. CLICKing causes the brush to paint its shape, the spray can to apply a shot of its pattern, or the paint can to fill in an enclosed area where it's poured. The pencil draws and the eraser erases while CLICKed. The rubber band line and shapes are drawn by DRAGging between two points. The shape icons can paint using one of five selectable line widths from the line width menu in the lower left-hand corner of the page.

The lasso defines an irregular shape to be captured for

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editing, while the edit box defines a rectangular box for editing. This allows rubber stamping of parts of the picture, and some other capabilities, too.

The alphanumeric set allows insertion of text into the picture from the keyboard using the selected font and style options. Fonts available are Woodhaven, Topeka, MonaCoCo, Fort Worth and Paris. Styles are plain, bold, italic, outline and shadow. Left, middle and right options in the style menu define the alignment of the entered text.

Display

A *CoCo Max* picture consists of two `PMODE 4` screens, one atop the other, to give a 512 pixel wide and 384 pixel high picture. This is the equivalent of having the top half in `PMODE 4,1` and the bottom half in `PMODE 4,5` in Extended BASIC. *CoCo Max* will only `LOAD` files with an extension of "/MAX," so you must rename a non-*CoCo Max* picture before you can `LOAD` it into *CoCo Max*. I was successful in using *Graphicom*'s "GC>BIN/BAS" program to convert a *Graphicom* picture to `LOAD` into *CoCo Max*.

CoCo Max always presents a graphics screen to the user. The upper border contains several menu selections that can be pulled down to give menu options. You pull the menu down by pointing to it and clicking.

The menu options are graphically displayed under the menu selected. You pick the menu option by pointing and clicking, too. The menu option pointed to is highlighted in reverse video to let you know you've pointed accurately, and a checkmark to the left indicates that the option is on, absence of a checkmark indicates the option is off.

The actual work area is about 208 pixels wide by 128 pixels high. You slide the work area around the picture by using the hand in the tool kit. A scroll page option in the goodies menu lets you move the entire picture in detail. The show page option in the files menu lets you visualize the entire picture in reduced detail.

Features

The files menu allows you to `LOAD`, `SAVE`, do a directory of *CoCo Max* pictures and `PRINT` pictures in double-size, double strike and single-size modes. You may also `CLEAR` the page (erase the picture), undo your last step (re-do it, too) or quit to BASIC. My disk version has no provision for cassette `SAVE` or `LOAD`.

The edit menu lets you copy, cut, and paste portions of a picture to/from the clipboard on the disk. You may also invert, clear, fill, trace edges or flip horizontal and vertical the pasted portion.

The goodies menu lets you select an invisible grid of 8 by 8 pixels that, when turned on, forces the end points of lines, boxes and circles to snap and lock on to the grid. "Fat bits" is a fixed zoom-in magnification of eight times normal size. "Show page" gives you an overall view of your picture in reduced detail. "Edit pattern" lets you change any of the 60 selectable patterns to a custom one, designed by you. "Brush shape" lets you select one of 32 different shapes for painting. "Brush mirror horizontal" and "vertical" lets you create symmetrical pictures by mirroring your brush strokes about the horizontal and/or vertical center of the page. "Inertia" is a special function to smooth out the jerky signal from the touch pad (it's not included in the version I have, but the manual discusses it).

Deficiencies

The major deficiency of *CoCo Max* is error reporting: it doesn't. I couldn't get *CoCo Max* to crash, but it doesn't report errors such as "disk full," either. I intentionally filled a diskette so only five granules remained free. The picture I wanted to save needed six granules.

CoCo Max `SAVE`d the picture, but *only* five granules of it, and didn't bother to report this to me. The next `SAVE` (the disk is full, now) turned the drive on briefly and returned to *CoCo Max*. The diskette structure was not destroyed, but a directory showed that the picture didn't get `SAVE`d.

Also, I succeeded in saving a file called "1:JUNK" on Drive 0; the "1:" was part of the name. Try to `KILL` that from Disk BASIC. *CoCo Max* has no provision for `KILL`ing files. My disk version of *CoCo Max* is a one-drive system. *CoCo Max* doesn't normally need the system diskette, except for certain `EDIT`ing functions and to `SAVE` or `LOAD` pictures.

Though not deficiencies, here are a few things I'd like to see added to *CoCo Max*: multiple drive support; a programmable zoom magnification; the ability to stretch areas horizontally and/or vertically; the ability to `SAVE` and `LOAD` edited patterns.

CoCo's *CoCo Max* vs. Macintosh's *Macpaint*

Having seen *Macpaint* first, I was skeptical when I saw Colorware's advertisement for *CoCo Max*, but the resemblance hooked me. Putting the two side by side, we began to look for Mac's 16-bit powerhouse 68000 to outpace its smaller eight-bit brother 6809 in CoCo. We were surprised at how CoCo stood up to the task!

Macpaint's picture is black and white, 512 pixels wide by 768 pixels high; four times the area of *CoCo Max*. *CoCo Max* presents an artifacted (more than two colors from a two-color mode) color display of a picture, even though it's a `PMODE 4` picture. Although *CoCo Max* can paint colored patterns in this mode, the colors change with detail and position on the screen.

Macpaint has a function that allows portions of a picture to be stretched horizontally or vertically. *Macpaint* has a file menu that includes new, open, close, revert and print catalog. *CoCo Max* has more patterns to choose from: 60 versus *Macpaint*'s 38. *Macpaint* has an additional option, "rotate" in the edit menu. *Macpaint*'s goodies menu has "introduction" (a help file), while *CoCo Max* has a "scroll page" option. *Macpaint* has more fonts and styles than *CoCo Max*.

I was certain Mac would be faster, and it is, but that's not to imply CoCo is slow. I did not find myself waiting for *CoCo Max* except a few seconds to fill large areas, about half a page, or to capture a detailed area with the box edit function. A fill that took CoCo 2.4 seconds took Mac 1.3 seconds (remember Mac is filling four times the area of CoCo).

Conclusions

This software/hardware graphics system is an outstanding buy for the performance achieved. I am pleased that Colorware's advertisement accurately described the product and that their delivery was timely, as promised.

(Colorware, Inc., 78-03F Jamaica Ave., Woodhaven, NY 11421, 64K, joystick, mouse or touch pad required, disk $69.95 plus $3 S/H)

Double CoCo's Serial Port With Data Line Switch Box

All of us have known the pain of wanting to use two RS-232 devices on our CoCo's one serial port. Many switch devices are already on the market to let you hook up two, or even three peripherals to your one port. A new entry is Phelan Enterprises' Data Line RS-232 Switch Box.

The Data Line Switch Box is a device to hook any two peripherals to the CoCo's single serial port. It consists of a 4" x 2" x 1" plastic box with one cable to hook to the CoCo port, and another two cables for peripherals to plug into. On the top are two switches to change which peripheral the computer is responding to.

Data Line does exactly what it is advertised to do, but I feel it has several shortcomings. The first is the use of two toggle switches, both of which must be flipped to switch peripherals. Also, the switches have a mysterious center position which is not documented. In my testing, I found it was very easy to think you've switched both switches, but actually leave one in the center position.

My second objection is with the price. Data Line is advertised at $39.95. Other advertisers in RAINBOW are offering similar products at $19.95 and I know of superior products of this type at $29.95. These other products offer metal casing and one switch to do the job of the two used in Data Line. Rather than a professional product, Data Line looks like a very well-done project from "Turn Of The Screw."

The only documentation with the product is one page of computer print (dot matrix at that) with very skimpy instructions. The documentation also gives information on your warranty, which is 90 days.

Dr. Megabyte cannot prescribe this product because the bill is too high for the performance delivered. If Phelan can lower its price to the point where it matches the performance, it would get a much better recommendation. As it is, I would have to advise you to carefully look at very similar products' prices before buying this one.

(Phelan Enterprises, 4704 Bluejay Court, Fayetteville, NC 28304, $39.95)

— Mark E. Sunderlin

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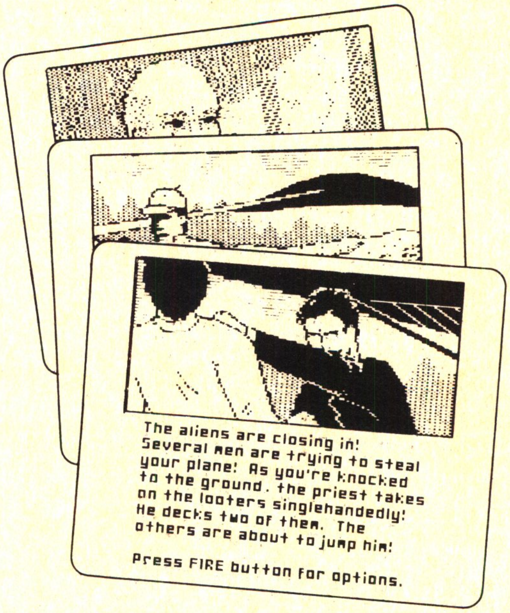

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Aut-O-Start Is Your Cassette Program's Best Friend

If anyone has ever, or ever will have, written a program for a tape system to be marketed, your best friend could be *Aut-O-Start* by Spectrum Projects. This amazing program will do several things: it will allow you to make impressive title screens, auto-load BASIC or machine language programs (from cassette), load BASIC programs anywhere above `PCLEAR 0`, and protect your program from pirates.

When you have your program ready to be marketed, the first thing you must do is save it to cassette. After doing this, you can then put the *Aut-O-Start* tape in your recorder. All that is needed to load and start the program is `CLOADM`, then hitting ENTER. After awhile, the program will display a colorful title screen and continue to load the program.

When the program is totally loaded, you will see the main menu. This has three options: Create Title Screen, Produce Program Tape or End Program. The first choice will allow you to create a screen to go with your program. Within this option, you are allowed to choose background and boundary colors using the up- and down-arrow keys, edit the title screen with certain key sequences, save and load title screens, and go back to the main menu. While editing the title screen, you may change cursor color, reset border color, set text mode to allow for text in your title screen, move the cursor with or without leaving a trail of the selected color or switch between graphics only and graphics and text modes.

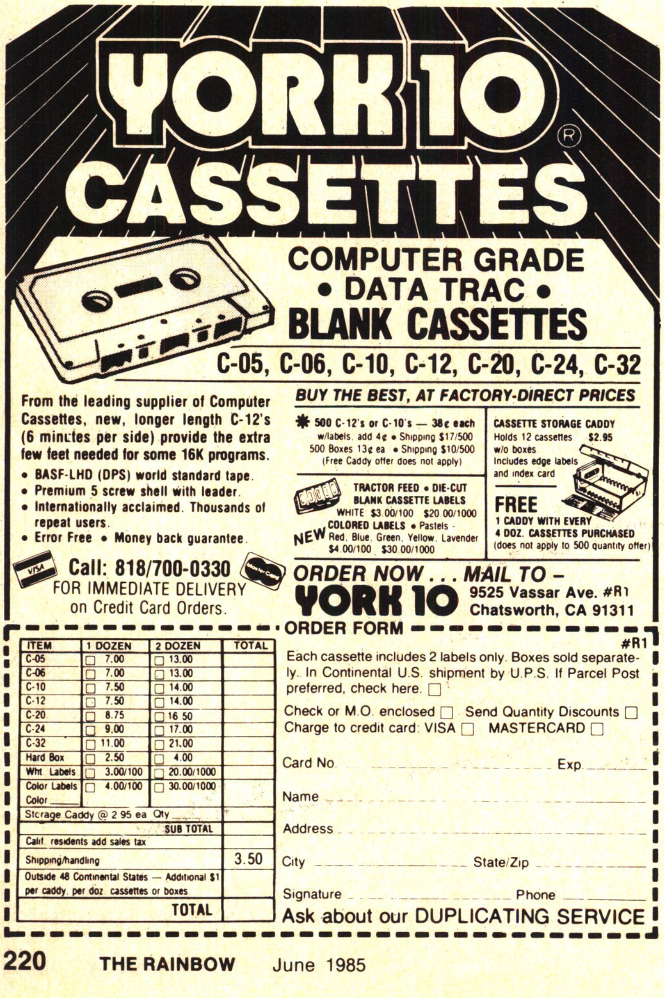
The next option is Produce Program Tape. This will lead you to another menu which allows you to define parameters, save *Aut-O-Start* to tape or return to the main menu. The parameters to be defined are as follows: "Do you wish to have a title screen?" "Is the program in BASIC or Machine Language?" "Where does your BASIC program start (`PCLEAR` Values)?" and "Do you wish to protect your program?" The first two are self-explanatory. The next (start address) is, simply put, a `PCLEAR` value to use before loading the program.

The final one is the most interesting. The "protection" is to protect against most tape-to-disk copy programs and against the user breaking the protection by "skipping past" the loader section. That is to say, with some protections, all you have to do is skip the loader, then load the program as you normally would. *Aut-O-Start*, however, will not allow that. After doing all of this, you simply `CSAVE` or `CSAVEM` your program and *Aut-O-Start* will do the rest.

I think *Aut-O-Start* is an excellent program for those who need it to protect a product they are marketing. It would be extremely hard for someone to break the protection and look at your source code for devious purposes. If you need a safeguard, this product is definitely for you.

(Spectrum Projects, Inc., P.O. Box 21272, 93-15 86th Drive, Woodhaven, NY 11421, $19.95 plus $3 S/H)

— Jim Sewell



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One-Liner Contest Winner . . .

A tribute to Roy G. Biv, whom the author first met in high school. (Who is he, anyway?)

The listing:

```
0 PCLS:R$="U6R3FDGL3RF3BR4":O$="
BRHU4ER2FD4GL2BR7":Y$="BR2U3E2UB
L4DF2D3":PMODE3:SCREEN1,0:COLOR4
,2:FORS=4TO16STEP4:FORA=0TO3:S$=
"S"+STR$(S):A$="A"+STR$(A):R=6*S
:CIRCLE(128,96),R:DRAW"BM128,96"
+S$+A$+R$+O$+Y$:FORB=0TO300:NEXT
B:PCLS:NEXTA:NEXTS:GOTO
```

E.L. Higdon
Grain Valley, MO

(For this winning one-liner contest entry, the author has been sent copies of both *The Rainbow Book Of Simulations* and its companion *Rainbow Simulations Tape*.)

Adventurus Supremus 4.6B: A Departure From The Usual

I found myself standing at the front door of a house. Looking around, I saw a doormat under me, a door to the north and a road to the south. Hesitantly, I walked through the doorway, and that's when the fun began.

This is how I started Bacchus Computer Software's Adventure, *Adventurus Supremus 4.6B. Supremus* is a 16K BASIC, text-only Adventure game set in a pseudo-modern setting. The object of the game is to figure out a special verb and to apply it in a specific setting.

The documentation accompanying *Supremus* is quite thorough. It covers loading the game, running it, how to win, how to play an Adventure, how to contact Mr. Marcelletti for advice, and a verb list as well as a couple of other things!

The Adventure itself is not of the standard genre. Most of the locations are within a house, but there is also a gazebo and a desert with sand stretching for miles and miles. I encountered a big, mean ogre, as well as a calm looking man. The room descriptions were colorful and gave a sense of actually being there. A couple of situations (which I shall not name for fear of giving away anything) I've seen in other Adventures. These do not really detract from the Adventure, though.

There are, however, some bad points about *Supremus* that I must bring up in order to be fair to the readers of this review. First of all, I found it slightly annoying that the Adventure did nothing to tell you if it didn't understand what you just typed in. Also, the use of "OK" as a prompt is almost maddening. I get enough of that smug little word in BASIC, I don't need it in an Adventure, also!

To continue, I found a couple of things offensive, these being "R-rated" actions. One of these is pointless, getting you killed; the other action you must perform in order to progress further in the Adventure. Lastly, in order to run this Adventure on a 16K ECB computer, you must perform the infamous `PCLEAR 0` with a `POKE 25,6`, etc. I have no objection to this if the program truly will not fit into less space, but *Supremus* is written in a very inefficient way and could be written so the `PCLEAR 0` wouldn't be needed.

All in all, *Supremus* is not a bad Adventure when one considers the price. It could be more efficient, and the R-rated actions really aren't necessary in this Adventure. I'm probably being picky, but I would not suggest this Adventure be purchased for young children. Also, *Supremus* is not the easiest Adventure I've ever played, so novices beware!

This is one of the lowest priced Adventures I've ever seen. If you really want to play something "different," buy *Adventurus Supremus 4.6B*; for $9.95, it's a good deal.

(Bacchus Computer Software, P.O. Box 265, Paw Paw, MI 49079, cassette $9.95 includes S/H)

— Lewis R. Jansen

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P51 is an excellent Simulation. Unlike other Simulations, you can play by yourself, or with two computers hooked together either directly or through a modem.

The one-player version is usually used to get acquainted with the Simulation. The "enemy" in this mode is a drone that keeps on the same course and doesn't fight back. Although you don't do much fighting in this version, you can shoot down the drone for practice. I like using this version just as a regular flight simulator since it has the same basic elements as other flight simulators.

With two CoCos hooked together or through modems (the modem is a little slower), it is especially fun because the two computers are independent of each other. During this time, you can use any of the modes. It is not like other two-player games/Simulations where you both attack the same thing for points, but you attack each other, trying to shoot down your opponent's plane.

It takes at least 15 hits to shoot the other person down, so it's not one of those one-hit-and-it's-all-over type Simulations. Each hit before destruction of the craft causes some sort of damage which I'll talk more about later.

There are four modes in which you can play. Peace is self-explanatory as is the war mode. In the "talk" mode, if you're playing through the modem or directly connected, the program will cause a distinct beeping sound on both computers. This will alert the other person that you want to talk. If he/she switches to this mode, the game will freeze and you can pick up the phone and talk to each other without messing up the game presently going on.

The last mode, turkey, is the equivalent of challenging the other player to a fight and if he answers it, the Simulation automatically switches to the war mode.

P51 offers four quadrants. In each quadrant, there is a north-south runway. When playing by yourself, you can land safely at any field, but during dogfight mode, you can only land on your own fields. You start out with two fields and can gain more by shooting out the beacons next to your opponent's field five times. When you land on your own field, you get a full load of bullets and fuel.

Unlike other flight Simulations, you have a radar you can access while flying to find your enemy's position. Also, there are three skill levels which determine how many bullet holes are inflicted by each hit. Some of the damages I mentioned before include: reduction of your engine power, guns jamming, can't reduce/increase power, landing gear breaking or some of your instruments malfunctioning.

There are two negative points I feel are worth talking about. The first thing is that the graphics are limited. About the only things shown are your instruments, cross hairs (target finders), airfield markers and the enemy plane. The horizon is shown by the line where the ground and sky meet. The documentation explains that the programmer lives in Kansas and has never seen a hill.

The other problem will be evident to the people who buy flight Simulations just for the real life experience; they will notice there is no rudder control. This is for ease in the Simulation. The documentation explains that a rudder is not needed and why.

All in all, *P51 Mustang Attack Flight Simulator* is a very good and realistic Simulation. I think it's worth the money and recommend it.

(Tom Mix Software, 4285 Bradford N.E., Grand Rapids MI, 49506, tape $29.95, disk $34.95)

— Donald A. White

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SBASIC — BASIC With A Foreign Accent

After spending a few hours reading and pondering over the user's manual for this program, I was reminded of my efforts to learn pidgin English during my wanderings among the South Pacific Islands. In those days, I began to wonder why the natives could not just learn the English word "piano," instead of saying "big box beatem teeth noise come out." Some of *SBASIC*'s user's manual language is equally as frustrating.

The user's manual describes *SBASIC* as a machine language utility to convert structured BASIC commands into Color BASIC.

After spending many hours trying to understand and operate this program, following the manual and trying all the samples in the manual with confusing results, I invested a few dollars in a telephone call to the author in Canada. I told him I thought most of his prospective purchasers of *SBASIC* would be nonexpert programmers who would like to have clearer and more detailed instructions. I asked that he send me step-by-step instructions on how to use at least two of his examples. I received a sheet to be inserted into the user's manual, but it adds little to clarity.

My next step was to prepare several short programs which I thought would demonstrate the use of *SBASIC*, and ask *SBASIC* to work its magic on them. I found that the Compile portion of the program would change some pidgin into English, and make certain translations from *SBASIC* to Color BASIC.

The Pack portion of the program eliminated leading blanks and unnecessary colons which were placed in the test programs to make them easier to read when printed. Pack, however, did not take out other unnecesary spaces nor combine lines to reduce the number of bytes unnecessarily consumed by the program.

I could see no great improvement over CoCo's Extended BASIC. The first three examples given in the user's manual are examples of *SBASIC*'s substitute for BASIC's `FOR/NEXT` statement:

Example

```
10 I=1:Total=0
20 LOOP
30 :  TOTAL=TOTAL+PART(I))
40 :  I=I+1
50 UNTIL(TOTAL>1000)
60 END
```

When the first example was put through the Compiler, the only change was that Line 20 was changed to `20 REM`, but indicated an SN Error in Line 10. When put through the Pack portion of the program, the result was to eliminate the colon and leading spaces in lines 30 and 40. The second example resulted in an SN Error in Line 20. The third example had similar results.

Two examples were given of *SBASIC*'s substitute for BASIC's `IF/THEN/ELSE`.

Example

```
10 SIF(A>127)THEN
20 :  A=A-128
30 :  PRINT"NUMBER WAS TOO LARGE"
40 ELSE
50 :  PRINT"NUMBER OK"
60 ENDIF
70 END
```

Are these really improvements over BASIC?

It could be likely I was doing something wrong, but I followed the user's manual to the letter, time after time. I believe that this is the proper way to review a program: The reviewer should follow the instructions exactly. The program and the manual must be taken as a package and if the package, taken as a whole, does not work, it is in need of revision.

If one has written a long program in easy-to-read form, and wishes to eliminate the colons and blanks which have been inserted just to make it easy to read, the Pack portion of *SBASIC* would be useful in "tightening up" the program. To me, this would be the most valuable part of *SBASIC*. However, similar "Pack" programs are in the public domain. I do not believe I would use the other parts of the program, as I do not see any great advantage of the *SBASIC* language over Extended BASIC language.

The least that Tandar Software should do is rewrite the user's manual so an average, novice programmer could easily understand it and operate the program from the information in that manual.

(Tandar Software, 12 Araman Drive, Agincourt, Ontario, Canada M1T 2P6; $19.95 U.S., $24.95 Canadian)

— Charles L. Redman, Jr.

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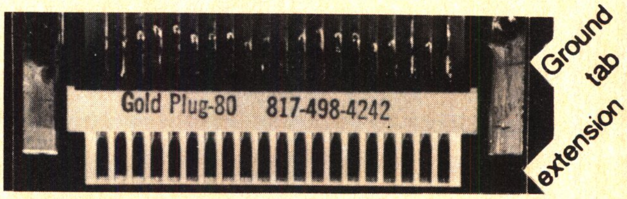

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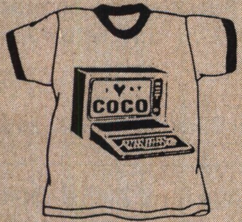

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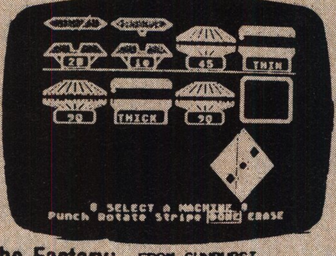

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CORRECTIONS

"PERT" (March 1985, Page 140): Jorge Mir tells us he's had some reports of problems having to do with various printers. PERT was written for the Okidata Microline 92 printer, and these special effects codes are used:

CHR$(12)	Feed paper to beginning of next page (most printers have this)
CHR$(28)	Select elite font (96 chars/line)
CHR$(29)	Select compressed font (132 chars/line)
CHR$(30)	Select normal font (80 chars/line)
CHR$(31)	Switches on double-emphasized mode

If you have some other printer, you will need to change the printer codes contained in lines 1740, 1800, 1810, 2320, 2330, 2470, 2480 and 2500 to make the special modes work with your printer. If your printer does not have the elite (96 characters per line) font, the compressed font will work. Also, on most other printers you will need to use two modes (emphasized and double-strike) in combination to create the double-emphasized mode.

The Okidata printers automatically clear the double-emphasized mode when changing fonts; if your printer doesn't, you will need to insert the necessary codes as well.

If your printer doesn't have the form feed function, change the following two lines to read as follows:

```
1800 IF INT(I/58) = I/58 THEN FO
R XX=1TO6:PRINT#-2,"":NEXTX
1810 NEXT I
```

Finally, all users should change the word PAINTRICAL in Line 2400 to read CRITICAL.

"Restoring BASIC Programs" (April 1985, Page 14): Richard Benton advises us that our description of his program was incorrect. First, he says the version given will only work on disk systems because the machine language code falls in the cassette I/O buffer area. To create a cassette version, change lines 10 and 40 to read as follows:

```
10 CLS:FORI=600TO630:READA$:POKE
 I,VAL("&H"+A$):NEXT

40 CSAVEM"RESTORE",600,630,600
```

It should be emphasized that the BASIC program creates disk or cassette copies of the ML code, and the resulting saves are the program that actually does the work. If you were to load the BASIC program after the system crashes, it would replace the program you are trying to recover. (If you have a cassette system, you may want to keep the ML program on a separate tape.)

"CoCo Becomes The Paymaster" (March 1985, Page 58 and April 1985, Page 82): Dennis Weide informs us that a few changes need to be made in the *EMPLOYER* and *CKWRITER* programs. Add the following lines to *EMPLOYER* to allow editing of state taxes:

```
14650 PRINT"STATE TAX TOTAL":INP
UT B1$:IF B1$="" THEN 14700 ELSE
 TL=VAL(B1$)
15550 PRINT"STATE TAX TOTAL":INP
UT B1$:IF B1$="" THEN 15600 ELSE
 YL=VAL(B1$)
```

Edit the following lines in *EMPLOYER* to read as follows:

```
14600 PRINT"FED. INC. TOTAL":INP
UT B1$:IF B1$="" THEN 14650 ELSE
 TF=VAL(B1$)
15500 PRINT"CONTRIBUTIONS":INPUT
 B1$:IF B1$="" THEN 15550 ELSE Y
C=VAL(B1$)
```

Edit the following lines in *CKWRITER* to read as follows (to allow printing of first names with over six characters):

```
17300 FOR Q=1 TO LEN(A$):IF MID$
(A$,Q,2)="  " THEN NA$=LEFT$(A$,
Q):GOTO17500:ELSE NA$=A$
17500 FOR Q=1 TO LEN(B$):IF MID$
(B$,Q,2)="  " THEN NB$=LEFT$(B$,
Q):GOTO17700:ELSE NB$=B$
```

"We Want Our Q-NERD!" (May 1984, Page 175): Jerry Forsha tells us that two lines have to be modified for use on the Color Computer 2 or any other CoCo that has the Color BASIC 1.2 ROM:

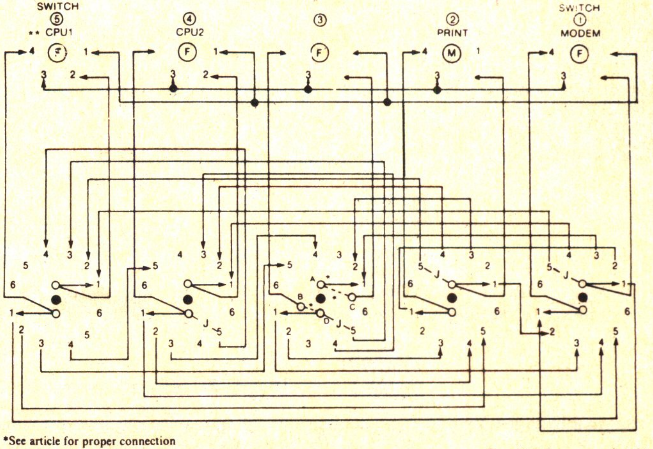
Delete Line 1, then edit Line 55 to read as follows:

```
55 SCREEN1,0:SC=0:Y2=56:M=3:YP=1
70:C=3:CS=1:SS=4000:INKEY$="":GO
TO10
```

Routing Switcher (April 1985, Page 32): Michael Lill tells us that there are some errors in the schematic diagram on page 33. Here is the corrected schematic:

Figure 1

ROUTING SWITCHER
— 232 —



*See article for proper connection

**CPU#1 can monitor other outputs with "-J-" Jumpers as shown

Drawing is from connection side

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SEDIT or SDOS can use 24 by 80
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TYPE: Document Processor

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according to embedded commands
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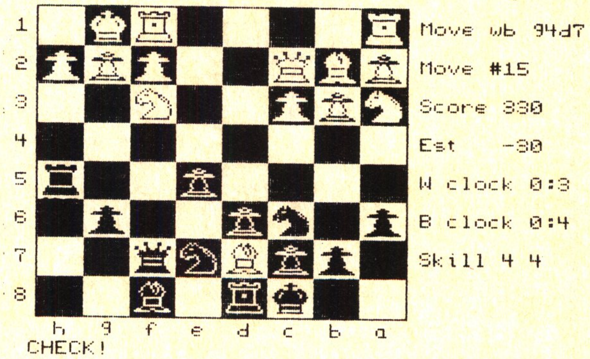

```
Move wb 94d7
Move #15
Score 330
Est   -30
W clock 0:3
B clock 0:4
Skill 4 4
CHECK!
```

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SCHOOL IS IN THE HEART OF A CHILD

4K

Wandering Star Learns To PEEK

> *I know it is in my heart. It reaches out to my mind. It speaks to my soul. Yet, I see it only dimly — a key to the future. A child approaches and touches it. She laughs and claps her hands. I see, because she has made it clear.*
>
> *— Laran Stardrake*

By Bob Albrecht and Ramon Zamora
Rainbow Contributing Editors

"School Is In The Heart Of A Child" is for parents of quite young children. We want to help you work and play with your 3- to 8-year-old child and learn to use computers as a joyful family experience. We suggest ways to use the home computer as another means to encourage your child's independence, growth and control over his own life. See the pride on her face as she directs the computer to do what she selects with deliberation. See her head gears switch to "on" as she progresses step by step with your presence and caring guidance. We will explore (we hope, with your help) the following:

- Specific "teaching" techniques so the discovery can be the child's own.
- Critical evaluation of software based on extensive playtesting in family and related environments.
- Additional resources to consult: books, magazines, software publishers, networks, etc.
- Suggestions for interludes and fun times away from the computer (a must!): call the librarian for information; watch TV together and discuss it; work together as volunteers in a community project; take an "awareness" walk . . .
- Whatever we learn from families we work with in Menlo Park or from you, our readers. Let's pool our knowledge and share our experiences as we learn from our children.

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(Well-known author Bob Albrecht co-authors the "Game Master's Apprentice" feature for THE RAINBOW *each month. Ramon Zamora is author and co-author of several books, co-founder of Computer Town USA!, and currently designing computer games for kids at Child Ware Corp. in Menlo Park, Calif.)*

Wandering Star, as regular readers know, is a hungry creature who subsists on cosmic dust motes. Your CoCo's TV screen is her universe.

Wandering Star sometimes moves next to a cosmic dust mote, then moves away. Let's teach her how to "peek" at nearby places to see if any cosmic dust is there. If there is, she will move directly to it instead of wandering randomly — a much more efficient way to gather food.

Remember, print positions on the screen are numbered from zero (upper left corner) to 511 (lower right corner). For each screen position, there is a corresponding location in the CoCo's memory. These memory locations are numbered from 1024 to 1535.

- — Memory location 1024 corresponds to screen position zero
- — Memory location 1025 corresponds to screen position one
- — And so on. Memory location 1535 corresponds to screen position 511

You can easily compute the memory location that corresponds to a given screen position.

memory location = screen position + 1024

You can also easily compute the screen position that corresponds to a given memory location, provided the memory location is in the range 1024 to 1535.

screen position = memory location - 1024

For each character on the screen, the CoCo keeps the character's ASCII code in the memory location that corresponds to the screen position of the character.

- — The code for short-tailed cosmic dust (.) is 46
- — The code for long-tailed cosmic dust (,) is 39
- — The code for cosmic escargot (@) is 64

If screen position 235 contains a short-tailed dust mote (.), then memory location 1259 contains the number 46. If screen position 400 contains a long-tailed dust mote (,), then memory location 1424 contains the number 39. Suppose screen position 510 contains one cosmic escargot (@). The corresponding memory location is 510 + 1024 = 1534. Location 1534 contains the number 64, which is the ASCII code for '@.'

Now learn how to `PEEK` into a memory location and find out what number is there.

- — Press the CLEAR key
- — Type `PRINT PEEK(1024)` and press ENTER

Don't abbreviate `PRINT` with a question mark — type the word `PRINT`. The screen should look like this.

```
PRINT PEEK(1024)
 80
OK
■
```

PEEK into memory location 1024

You told the CoCo to `PEEK` into memory location 1024 and `PRINT` the number stored there. Remember, memory location 1024 corresponds to screen position zero. The letter 'P' is in screen position zero. The ASCII code for 'P' is 80, so the CoCo printed 80. Try another.

- — Press the CLEAR key
- — Type `PRINT PEEK(1535)` and press ENTER

The screen looks like this.

```
PRINT PEEK(1535)
 96
OK
■
```

PEEK into memory location 1535

This time you `PEEK`ed into memory location 1535 which corresponds to screen position 511. That screen location is solid green, so we thought the CoCo would print 143, the ASCII code for the solid green graphics character. Not so! If you clear the screen by pressing the CLEAR key (or by typing `CLS`), the CoCo puts the code 96 in every memory location that corresponds to a screen position. Try this.

- — Type `CLS 1` and press ENTER
- — Type `PRINT PEEK(1535)` and press ENTER

The screen looks like this.

```
OK
PRINT PEEK(1535)
 143
OK
■
```

When you use `CLS 1` to clear the screen, the computer puts 143 into memory lcoations 1024 to 1535. Hmm . . . what if you use `CLS 0`, `CLS 2`, `CLS 3`, `CLS 4`, `CLS 5`, `CLS 6`, `CLS 7` or `CLS 8`? Try it and find out. Then try one more example.

- — Press the CLEAR key
- — Type `PRINT @80, "@"` and press ENTER
- — Type `PRINT PEEK(1104)` and press ENTER

The screen looks like this.

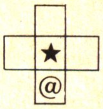
```
PRINT @80, "@"
                                  @
OK
PRINT PEEK(1104)
 64
OK
■
```

Cosmic escargot at screen position 80

You cleared the screen, put a byte of cosmic escargot at screen position 80, then `PEEK`ed into the memory location corresponding to screen position 80: memory location = 80 + 1024 + 1104. Just what you expected — 1104 contains the ASCII code (46) for a byte of cosmic escargot (@). Go gobble it up, Wandering Star!

Now we will give Wandering Star a program that lets her peek one place right, left, down or up to see if there is anything to eat nearby.

Nothing to the right.
Nothing to the left.
Aha! Cosmic escargot one place down.



470 247
END 147

Listing 1: `OASIS`

```
100 REM**WANDERING STAR SCH 14-1
110 CLS
199 '
200 REM**GOURMET OASIS
210 MENU$ = ".......,,@"
220 FOR K=1 TO 100
230 : GD = RND(10)
240 : GD$ = MID$(MENU$,GD,1)
```

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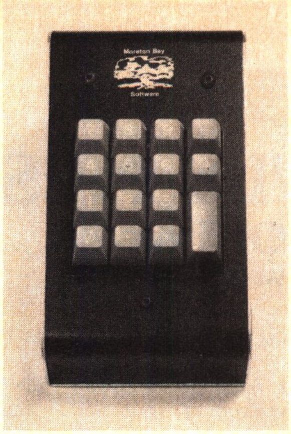

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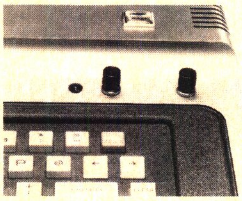

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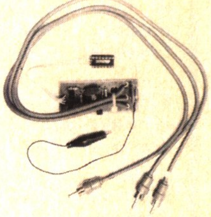

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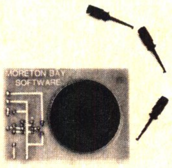

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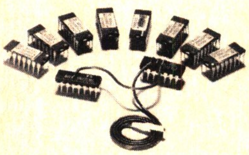

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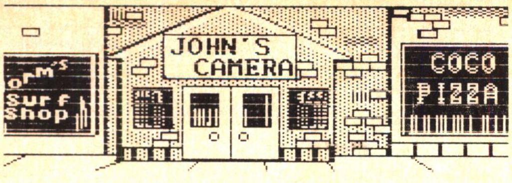
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JOHN'S CAMERA
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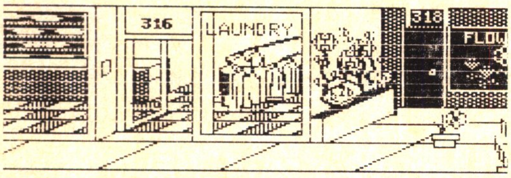
316
LAUNDRY
318
FLOW

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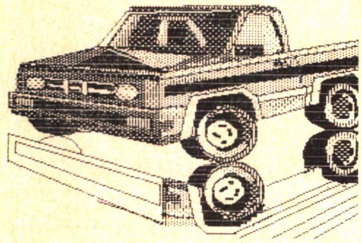

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How to integrate Graphicom and CoCoMax. Two tutorial disks full of examples and suggestions. See how to create graphics step by step. Learn how to display and even animate your graphics from Basic.

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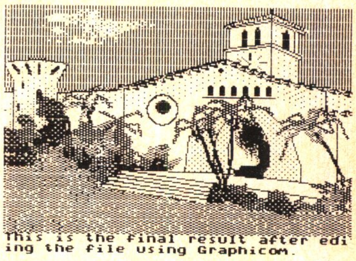

This is the final result after editing the file using Graphicom.

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An incredible graphic utility. Fun. Easy. Create graphic screens as good as any you have seen. All you need is a joystick or mouse. "The most user friendly program I have ever seen for the CoCo. For those of you with graphic interests, I guarantee that you will not be disappointed." Review in *Rainbow*, Oct. 1984.

Requires 32K EXB
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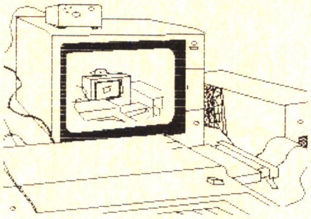

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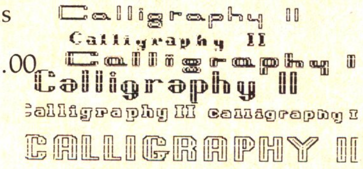
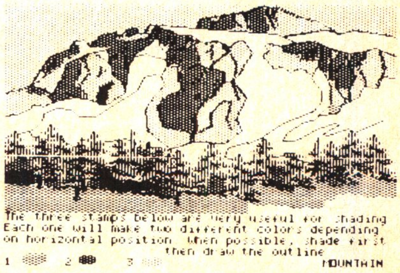
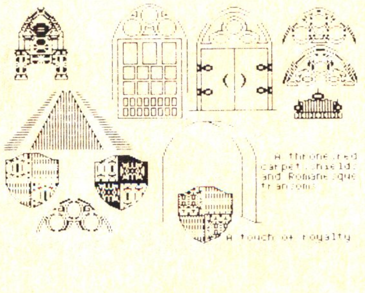

Calligraphy II
Calligraphy II
Calligraphy II
Calligraphy II
Calligraphy II calligraphy II
CALLIGRAPHY II

Calligraphy Disk II: 23
New letter stamp sets


The three stamps below are very useful for shading
Each one will make two different colors depending
on horizontal position. When possible, shade first
then draw the outline
1
2
3
MOUNTAIN

Adventure Disk II


A throne, red carpet, shields and Romanesque transoms
A touch of royalty

Adventure Disk 1

1 Picture Disk $15.95
2 Picture Disks $24.95
3 Picture Disks $29.95
4 Picture Disks $34.95

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```
250 : PRINT @RND(510), GD$;
260 NEXT K
299 '
300 REM**WANDERING STAR APPEARS
310 WS$ = "*"
320 R = 7: RN = R
330 C = 16: CN = C
340 SP = 32*RN + CN
350 PRINT @SP, WS$;
360 FOR ZZ=1 TO 1000: NEXT ZZ
399 '
400 REM**WS PEEKS R, L, D, U
410 ML = SP + 1024
420 IF C<31 THEN PR=PEEK(ML+1)
430 IF C>0  THEN PL=PEEK(ML-1)
440 IF R<15 THEN PD=PEEK(ML+32)
450 IF R>0  THEN PU=PEEK(ML-32)
460 IF PR<>96 THEN CN=C+1: GOTO
710
470 IF PL<>96 THEN CN=C-1: GOTO
710
480 IF PD<>96 THEN RN=R+1: GOTO
710
490 IF PU<>96 THEN RN=R-1: GOTO
710
499 '
500 REM**NO FOOD-MOVE RANDOMLY
510 W = RND(4)
520 IF W=1 THEN CN = C + 1
530 IF W=2 THEN CN = C - 1
540 IF W=3 THEN RN = R + 1
550 IF W=4 THEN RN = R - 1
599 '
600 REM**KEEP HER IN THE OASIS
610 IF CN<0  THEN CN = 0
620 IF CN>31 THEN CN = 31
630 IF RN<0  THEN RN = 0
640 IF RN>15 THEN RN = 15
650 IF 32*RN+CN=511 THEN 510
699 '
700 REM**WANDERING STAR WANDERS
710 PRINT @SP, " ";
720 R=RN: C=CN: SP=32*R+C
730 PRINT @SP, WS$;
740 SOUND RND(255), 1
750 FOR ZZ=1 TO 20: NEXT ZZ
799 '
800 REM**GOTO DIRECTION SELECTOR
810 GOTO 410
```

Perhaps You Have Some Patterns in Mind

Perhaps you have a plan in mind — a pattern of patterns or a sequence of sequences. You would like your student, child or friend to experience first this pattern, then another and another. You have a plan which begins with easy patterns, then slightly more difficult, then more difficult, etc. It is your plan, do it your way.

Instead of letting the CoCo select random number patterns, you can prescribe a sequence of patterns. The following program allows you to do this. All *you* have to do is rewrite the `DATA` statements, so your plan replaces ours.

Listing 2: `PATTERNS`

```
100 REM**NMBR PATTERNS SCH 14-2
110 CLS
120 PRINT "TRY SOME NUMBER PATTE
RNS.": PRINT
130 PRINT "PRESS THE spacebar TO
 BEGIN."
140 IF INKEY$="" THEN 140
199 '
200 REM**READ STARTING NUMBERS
210 CLS
220 READ S, A
230 IF S = 1E37 THEN PRINT "I'M
OUT OF PATTERNS" : END
299 '
300 REM**SHOW 'LATEST' NUMBER
310 PRINT @448, S
320 PRINT
399 '
400 REM**COMPUTE NEXT NUMBER
410 S = S + A
```

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THE SMART TEXT FORMATTER
FOR TELEWRITER-64®

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in memory formatting

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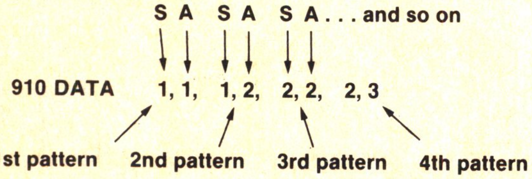
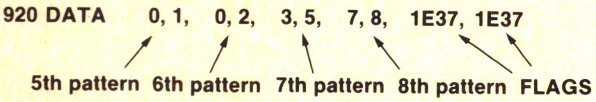
Telewriter is a trademark of Cognitec.

```
499 '
500 REM**WHAT TO DO NEXT
510 PRINT @480, "FOR NEXT NUMBER
, PRESS spacebar"
520 PRINT "FOR NEW PATTERN, PRES
S clear";
530 K$=INKEY$:IF K$="" THEN 530
540 IF K$=" " THEN 310
550 IF K$=CHR$(12) THEN 110
ELSE 530
599 '
900 REM**VALUES OF S AND A
910 DATA 1,1, 1,2, 2,2, 2,3
920 DATA 0,1, 0,2, 3,5, 7,8, 1E3
7, 1E37
```

For each pattern, the two starting numbers, 'S' and 'A,' are stored in a DATA statement. These numbers are read by Line 220. The DATA statements are in lines 910 and 920.





The DATA statements have values of 'S' and 'A' for eight patterns, followed by two outrageous numbers, 1E37 and 1E37. These numbers are the flags which say: "There are no more numbers. We are not pattern numbers. We are here only to tell the computer there are no more numbers."

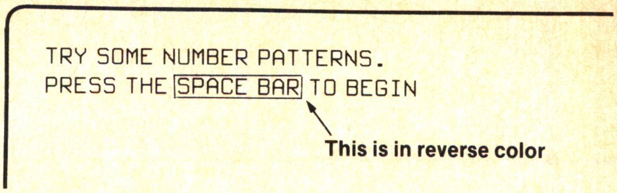
Why two flags? Because the READ statement (Line 220) reads two values. There must be two values, or an OD (Out of Data) Error message will occur when the CoCo tries to read two numbers in Line 220. The second flag is not used, but must be there.

With the above program, you can plan your sequence of sequences, or pattern of patterns. You pick each FIRST NUMBER and you pick each ADD-ON number. You pick each pair of numbers in the DATA statements. Use as many pairs as you want, then finish with two flags, 1E37 and 1E37. If you don't like our flags, use use your own. But, if you change the flags, also change Line 230 in the program. Please don't confuse the computer.

If you want geometric sequences instead of arithmetic, change Line 410 as follows:

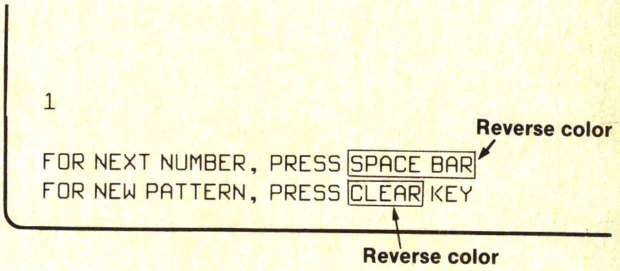
```
410 S = S*A
```

Try the program, using our DATA statements. It begins like this.



```
TRY SOME NUMBER PATTERNS.
PRESS THE SPACE BAR TO BEGIN
```

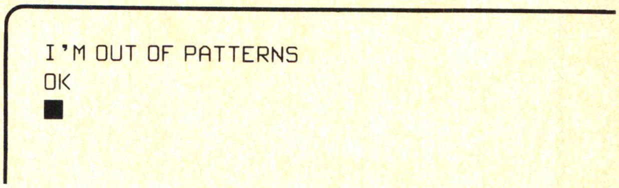
Press the space bar and the first pattern begins.



```
1

FOR NEXT NUMBER, PRESS SPACE BAR
FOR NEW PATTERN, PRESS CLEAR KEY
```

To continue with this pattern, keep pressing the space bar. To get the next pattern, press the CLEAR key. If all the starting numbers have been used, you will see the following message.



```
I'M OUT OF PATTERNS
OK
■
```

Do you want geometric sequences instead of arithmetic sequences? If yes, change Line 410 as follows:

```
410 S = S*A
```

DragonSmoke

DragonSmoke is our monthly newsletter about new ways to learn, including computers, role playing games, play-by-mail games, COPY ME stuff, public domain instructional materials, software for beginners, and our own play-by-mail game, *DragonFun*.

DragonFun is a play-by-mail role playing game for beginners. It is nonviolent and features cooperation, exploration, problem-solving and story-telling. How to play is described in the February 1985 issue of *DragonSmoke*. For a free copy, send a self-addressed, stamped envelope to *DragonSmoke*, P.O. Box 7627, Menlo Park, CA 94026.

See You At
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Hot CoCo, July '84 *"Instructions for using the system are excellent. The Order Entry System is an easy way to generate invoices and track sales. The Mark Data Products system is well worth its nominal price."*

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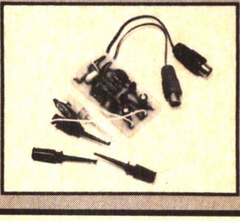

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All parts and complete instructions (For 'E' and 'F' boards and CoCo II)

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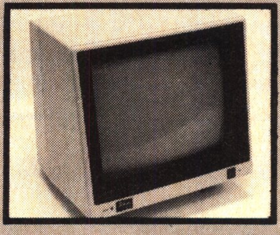
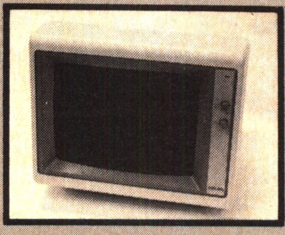


SAKATA COLOR SC-100 — $259.95

The SC-100 is a streamlined 13" composite monitor which produces sharp, brilliant colors. The cabinet is made of durable styrene and is available in an attractive off-white color. Includes audio with speaker and earphone jack. We highly recommend this color monitor because of its excellent performance and beautiful styling.



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A 12" amber screen composite monitor of the highest quality with exceptional reliability and performance. 18 MHZ bandwidth. Attractive off-white cabinet. We use this monitor in our offices.

Call for additional monitor information.

ACCOUNTING SYSTEM

Rainbow, May '84 *"Considering what it can do to organize a small business, it is quite a value."*

Hot CoCo, June '84 *"...a serious, professional accounting program and well worth its price. The programs are complete and simple to use."*

The Mark Data Products Accounting System is ideal for the small businessman needing a fast, efficient means to process income and expenses, prepare detailed reports and maintain most of the information required at tax time. The system is a family of programs which operate by means of a "menu" selection scheme. When the operator selects a task to perform, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary accounting reports including a transaction journal, a P & L or income report, an interim or trial balance and a balance sheet.

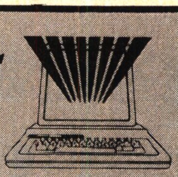
This accounting software equals or exceeds higher priced packages for other computers and includes a detailed operating manual. **ONLY $99.95**

NEW! DISC STORAGE

Attractive, heavy duty, smoked acrylic case. Holds and protects up to 75 5¼" discs with six moveable, indexed dividers.

SUPER BARGAIN — ONLY $10.95

SUPER SCREEN



The Color Computer Supercharger

- A big 52 character by 24 line screen
- 'PRINT @' is fully implemented on the big screen
- Easily combine text with hi-res graphics
- Auto-key repeat for greater keyboard convenience
- The 'ON ERROR GOTO' statement is fully implemented
- Control codes for additional function

Guaranteed to be the most frequently used program in your software library . . . once you use it you won't be without it! **Cassette $29.95 Disc $32.95**

Hot CoCo, Jan. '84 *"Super Screen represents a quality utility program that fills a definite need for the serious CoCo user. No other programs on the market so far have offered the error-trapping utility of Super Screen."*

Color Computer Magazine, May '84 *"Super Screen is a worthy addition to anyone's software library. It has become my most used utility and has made programming in BASIC on the Color Computer a joy..."*

NEW! ZOOKEY

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The combination of exciting game-play action and colorful, hi-res graphics in Zookey make it an outstanding typing tutor. Speed and skill levels are fully adjustable to train the beginner or challenge the most experienced typist.

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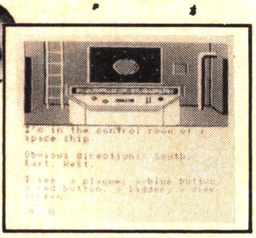
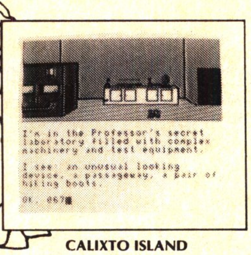


```
I'm in the control room of a
space ship.

Obvious directions: South,
East, West.

I see: a plaque, a blue button,
a red button, a ladder, a view
screen.
```

TREKBOER

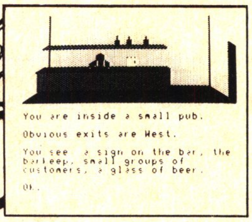
This exciting hi-res **adventure** begins aboard the starship Trekboer in the 21st century. Life on Earth is threatened by a deadly virus and your mission is to search the frontiers of space and return with a cure to save mankind from disaster.



```
I'm in the Professor's secret
laboratory filled with complex
machinery and test equipment.

I see: an unusual looking
device, a passageway, a pair of
hiking boots.

OK, 867
```

CALIXTO ISLAND

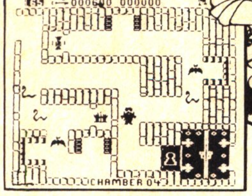
A valuable museum treasure has been stolen; can you recover it??? This is a challenging **adventure** with an occasional twist of humor. You'll visit a secret laboratory, a Mayan pyramid, and you'll meet crazy Trader Jack—all in living color and exciting detail.



```
You are inside a small pub.

Obvious exits are West.

You see  a sign on the bar, the
barkeep, small groups of
customers, a glass of beer.

OK.
```

SHENANIGANS

Countless legends tell of a magnificent pot of gold hidden at the end of the rainbow. Many have attempted to find the marvelous treasure but success has eluded them and it remains hidden to this day. You, as a dedicated **adventurer**, have determined to search for the fabled riches.



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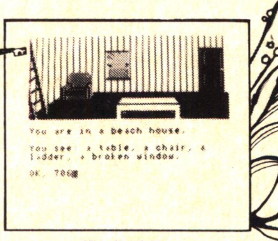
Explore the ancient, mystical tomb of the great Pharoah. Find the magical keys which lead you to unbelievable treasures as you outmaneuver the creatures that slither and swarm about you. Super fast **arcade** action—this one will knock your socks off.



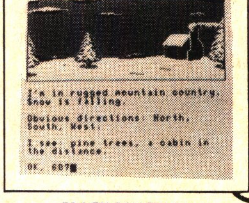
```
You are in a beach house.

You see  a table, a chair, a
ladder, a broken window.

OK, 786
```

SEA SEARCH

Get your shark repellant and scuba tanks ready! The graphics in this **adventure** are truly outstanding and the underwater scenes are unforgettable. You'll run into a pirate, a mermaid and some hungry sharks in this coloful and unique treasure hunt.



```
I'm in rugged mountain country.
Snow is falling.

Obvious directions: North,
South, West.

I see: pine trees, a cabin in
the distance.

OK, 687
```

BLACK SANCTUM

Encounter the forces of black magic as you roam around an 18th century monastery. You'll see all the evil locations in this spooky **adventure**; you'll love searching for and destroying evil in this classic tale. A MUST for every adventure game fan!

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BITS AND BYTES OF BASIC

Spreadsheet Application For Home Economics: Buying A Car

By Richard A. White
Rainbow Contributing Editor

What's buying a car got to do with spreadsheets or other computer programming? A lot if you use the spreadsheet in the process. I just went through that process. I knew pretty much what I wanted, so I didn't do many "what if" projections. If you feel like looking at a variety of makes and models, more spreadsheet use could be involved.

You can really get organized easily using a spreadsheet. And when you are organized, you can be on the offense with the dealer who is on the defense. Let's start the story.

First, I got $500 "free money" toward a new car. Some may remember when Chrysler announced record earnings in January, they also announced that all employees and all customers who had purchased a new Chrysler product between 1979 and 1984 would get a certificate worth $500 on a new 1985 car.

One must address these situations with great care. After all, my '72 station

(Richard White has a long background with microcomputers and specializes in BASIC programming. With Don Dollberg, he is the author of the TIMS *database management program.)*

Example 1

```
     [            A             ][   B   ][   C   ]
  1-           ITEM                 LIST      COST
  2-
  3-RELIANT SE KPH45 WAGON          7939      7063
  4-
  5-FREIGHT AND DEALER CHARGE        536       536
  6-
  7-H4  BENCH SEAT VINYL              31        26
  8-AAB POPULAR EQUIPMENT PKG        516       439
  9-     WSW TIRES
 10-     LIGHT PKG
 11-     AM/FM STEREO
 12-     PWR STEERING
 13-     LEFT REMOTE MIRROR
 14-     TINTED GLASS
 15-SDB HVY DTY SUSPENSION            58        43
 16-MCC BUMPER GUARDS                 56        48
 17-GFA REAR WINDOW DEFROST          143       122
 18-MWA LUGGAGE RACK                 116        99
 19-HAA AIR CONDITIONER              737       626
 20-TJA TIRE UPGRADE TO P185          36        31
 21-XPB UNDERCOATING                  43        37
 22-NHM AUTO SPEED CONTROL           179       152
 23-
 24-                TOTAL          10390      9222
```

PIZZA
PALACE

BUT...CHECKERBOARDS ARE FOR TABLECLOTHS!

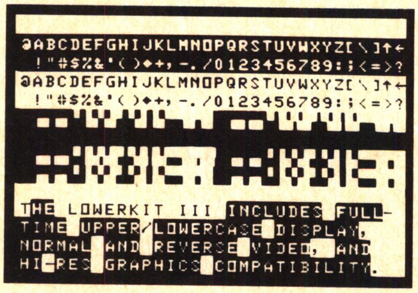
THE LOWERKIT III FROM GREEN MOUNTAIN MICRO

Still cloaking your Color Computer in a checkerboard tablecloth? Since 1981, thousands of Color Computer users have uncovered their computer by discovering the Lowerkit — the first and best full-time lowercase and special symbols generation system for your Color Computer.

Why a Lowerkit? Because uppercase-only display is a relic of the user-unfriendly past. And because you can't really read a checkerboard excuse for lowercase display. Sure, software lowercase comes with a handful of commercial programs. But software lowercase gobbles up over 6,000 bytes of your precious memory. Even if you have 64K, you'll give up 10% of it for a simple lowercase display. And software lowercase vanishes when you change programs or turn off your computer.

Take 15 minutes. Put the Lowerkit in. A Lowerkit is simple, reliable — and it's always there. You flip on your machine, and Lowerkit's bold lettering greets you. No tapes, disks or cartridges to load first. No compatibility problems; when you don't want it, you switch it off.

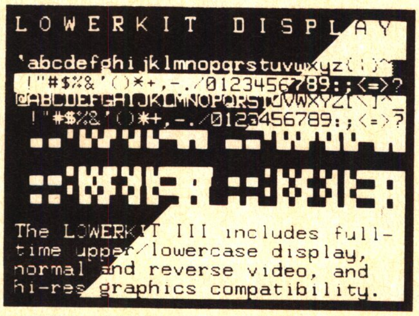
And now, the new Lowerkit III includes a reverse screen switch as well. Big, bright green letters on a black background.



```
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑←
 !"#$%&'()◆+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑←
 !"#$%&'()◆+,-./0123456789:;<=>?

THE LOWERKIT III INCLUDES FULL-
TIME UPPER/LOWERCASE DISPLAY,
NORMAL AND REVERSE VIDEO, AND
HI-RES GRAPHICS COMPATIBILITY.
```

Original Color Computer Display



```
L O W E R K I T   D I S P L A Y

`abcdefghijklmnopqrstuvwxyz{¦}~
 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^
 !"#$%&'()*+,-./0123456789:;<=>?

The LOWERKIT III includes full-
time upper/lowercase display,
normal and reverse video, and
hi-res graphics compatibility.
```

LOWERKIT III Display (reverse video, too)

Four years ago, the Lowerkit made history and set the standard in Color Computer lowercase. For example, game and education programs from Sugar Software have Lowerkit display options. Spectrosystems' ADOS supports the Lowerkit; so does Cer-Comp's TextPro. Cartridge Scripsit looks beautiful with a Lowerkit. Spectrum Projects, Cheshire Cat and many others have developed beautiful alternate character sets which you can download from Micronet, burn into an EPROM, and snap into your Lowerkit.

Pull the checkerboard tablecloth off your Color Computer with a **Lowerkit.** The original. The standard.

New Low Price on the Assembled Lowerkit III!

- Lowerkit III, assembled and tested, $67.50
- Lowerkit III, complete kit of parts, $49.95
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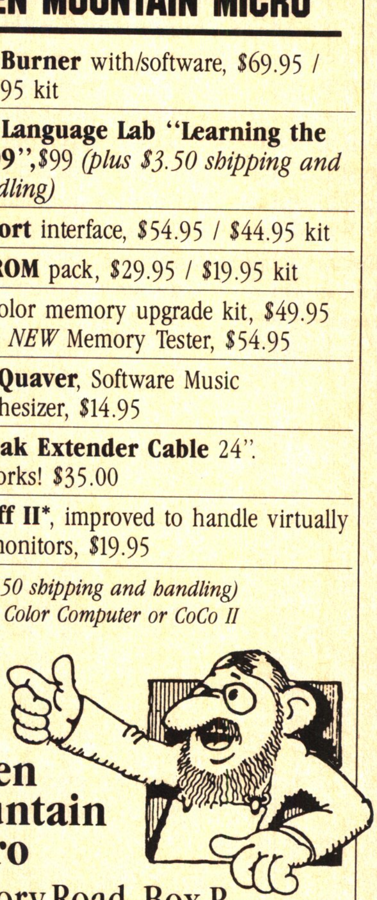
**Specify Color Computer or CoCo II*



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wagon was still getting from gas station to gas station and my '80 Horizon is still new by comparison.

I reflected for a couple of weeks. The station wagon was aging, rusting and pieces were falling off. Signals of middle age perhaps. But, a Tandy 1000 seemed a bit neater than a new car and is unlikely to rust. On the other hand, computers aren't mobile. It seemed a brief fact-finding trip to the local Dodge dealer would be in order for a new car consideration.

The dealer was out of station wagons and had only one car that cost more than four IBM PCs with a printer thrown in. I did get literature and stopped at a newsstand on the way home to buy a book containing both suggested retail and dealer costs for new cars and their options. Now I could rationally evaluate the situation from the safety of my easy chair with my wallet secured between me and the upholstery.

On the way home the next evening, I stopped at a Plymouth dealer who had no new wagons, either. He could sell me an '84 demonstrator where my Iacocca Certificate did not apply, and which did not benefit from the free automatic transmission promotion. I had the feeling I would pay more for that car than a new one ordered to my specifications. Time to do a spreadsheet.

Example 1 is the final spreadsheet for the car I ordered and is typical of what you might do a number of times as you narrow down your choices. All the data comes right out of the manufacturer's literature and the price book. The only formulae, @SUM(B1. . .B23) and @SUM(C1. . .C23), are in cells B24 and C24 which sum the entries in the columns of Example 1.

The formulae cover the entire column above the total row including the heading and the blank row above the totals. You can insert and delete any row within this range and the formulae will adjust themselves. This makes "what if" testing easy.

> ***"The one number you won't be able to exactly define without visiting the dealer is the freight and dealer charge. If you do a lot of looking and asking, you will pick up some examples of this and have a 'ball park' figure to apply to various cars."***

For example, you may have chosen three options that are also included in the discounted "popular options package." Save your current spreadsheet, then delete those options and add the popular options package. A recalculation shows the new totals which you can compare with those in the unmodified spreadsheet. Since the popular options package is discounted, you might find that $50 more buys $150 worth of options.

The one number you won't be able to exactly define without visiting the dealer is the freight and dealer charge. If you do a lot of looking and asking, you will pick up some examples of this and have a "ball park" figure to apply to various cars.

Those with printers will do well to print each sheet they make and take these along when they visit the dealers. On my next dealer visits, I had done some spreadsheets, but did not have them along. Having done the spreadsheets only the night before, I knew from memory what I wanted and the costs to the dealer for these.

Sensing I knew what I wanted, the salesperson got a scrap of paper, pencil and her price book and set about recreating my spreadsheet by hand. After minutes of writing, erasing, adding and subtracting, we had a list number to work from. I was thinking about how much easier the same thing had gone with *DynaCalc*.

The next day, we arrived with the Example 1 spreadsheet to finalize the order. Again pencils, papers and calculators came out as they strived to determine the price. The first cut price was wrong. They left out the vinyl seats. Finally they got it right. I should have

Example 2

```
   [     A      ][               B                 ][     C      ][    D    ]
 1-MONTHS        36                                  0-B1
 2-PRINCIPAL     8500                                (1+(B3/12))c1
 3-INTEREST RATE .125                                (1-C2)/(B3/12)
 4-              ---------
 5-PAYMENT/MO.   B2/(1-((1+(B3/12))H0-B1))/(B3/12)) B2/C3
 6-
 7-TOTAL PAYMENTS B5*36
 8-
 9-INTEREST PAID  B7-B2
10-
11-MONTH          1
12-START PRINCIPALB2                                 INTEREST      B12*(B3/12)
13-PRINCIPAL PYMT B5-D12                             PRINCIPAL     B12-B13
14-MONTH          B11+1
15-START PRINCIPALD13                                INTEREST      B15*(B3/12)
16-PRINCIPAL PYMT B5-D15                            PRINCIPAL      B15-B16
17-MONTH          B14+1
18-START PRINCIPALD16                                INTEREST      B18*(B3/12)
19-PRINCIPAL PYMT B5-D18                            PRINCIPAL      B18-B19
```

made two printouts and given them one to check. It would have saved some hassle and mistakes.

Next came the financing. I had looked in a few references for the formula for calculating monthly payments and came up dry when Herb Slodounik of Decatur, Ill., sent me a letter with the formula saying it works in *Elite*Calc*, but not in *DynaCalc*.

The book formula is P=B((1-(1+(I/12))^-N)/(I/12)). BASIC, *Elite*Calc* and *Multiplan* for other computers have a hierarchy of operators. In our equation, these "languages" would raise (1+(I/12)) to the power -N and then subtract that value from one. That is because raising to a power is above subtraction in the hierarchy. *VisiCalc*-type spreadsheets do not have such a hierarchy. Therefore, *DynaCalc* and *VIP Calc evaluate all math expressions on a strictly left to right basis, except as modified by parentheses*. This is extremely important since it is contrary to how you would solve equations using pencil and paper or how you would program the equation in BASIC.

Example 2 is a formula dump of a *DynaCalc* spreadsheet to calculate monthly payments given number of payments, amount financed (principal) and the interest rate given as a decimal number. An interest rate of 12.5 percent is entered as .125. These variables are entered in cells B1 . . . B3. The formula to calculate payments is in B5 and looks like this:

```
B2/(1-((1+(B3/12))H0-B1))/(B3/12))
          (--1--)  (-3--)  (--5--)
       (-----2--)
      (---------4--------)
   (---------------6-------------)
---------------7-------------------
```

The diagram below the equation shows the order of calculation and how the parentheses group. The innermost expression (B3/12) is calculated first. (1+Value1) and (0-B1) are at the same level so the left one is calculated first.

Note that *DynaCalc* will not accept (-B1), but (0-B1) works. The same cell construction is used in C1. Other spreadsheets are not so fussy. In Step 4 the raise-to-power operation occurs. At this point you should be able to reason out steps 5 through 7 for yourself.

To get to the equation in B5, I broke the book formula into pieces and put these into cells C1. . .C5. These produce the same answer in C5 as the full equation produces in B5. Many times it is easier to put work areas like C1. . .C5 outside the formal area of the spreadsheet and move their results back to where that value is to appear in a printout. Now the consideration is the order of calculation for the whole spreadsheet, rather than order of calculation for a specific formula.

A forward reference is where a formula in a cell uses a value from another cell that has not been calculated yet. A typical order is to calculate the values in Column A starting at Row 1, then the spreadsheet moves to Column B and does the same thing. This would work fine for the top part of our spreadsheet.

The last nine lines of the spreadsheet start a series of calculations that calculate how much of each payment goes to interest and to principal, then calculates the outstanding principal after each monthly payment.

In cell B12, the starting principal is brought down from cell B2. This value is used in cell D12 along with the interest rate from B5. The interest charged in D12 is subtracted from the monthly payment in cell B5 to get the amount available to reduce the principal. In cell D13, the starting principal for the month is reduced by the value from B13.

This spreadsheet arrangement becomes a disaster when columns are calculated from left to right. The calculation of the principal payment in B13 needs the interest payment from D12 which has not been calculated yet. The effect snowballs since the start principal in B15 needs the value from D13 which is not right because B13 is not yet right, etc.

You can manually cause a recalculation which will fix B13 and D13, but D13 is calculated too late for B15 to be right. In fact, two recalculations for each month in the spreadsheet would be necessary. With *DynaCalc*, you can change the order of calculation so rows are done in order down the spreadsheet and all our troubles go away.

*Elite*Calc* calculates rows down the spreadsheet in order from left to right. Example 2 is a very worst case situation that was not purposely designed to exemplify the problem, but which does so in spades.

VIP Calc also permits changing a default column-by-column calculation order to a row-by-row sequence using the Global command. The *VIP Calc* manual also warns against circular

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references that cannot be resolved. A trivial example follows:

```
    [     A     ][     B     ]
  1B1              A1
```

Cell B1 contains nothing but the formula A1. Cell A1 evaluates to zero since there is nothing in B1. Likewise B1 equals zero since A1 equals zero. Here no harm is done or anything useful done, but in more complex expressions, there is no telling what may happen.

For those who have hung in there up to now, Example 3 is the interest payment spreadsheet as you would see it without the formula dump.

I have shown only three months of the calculations of monthly principal and interest. The formulae for Month 1 are a bit different than for succeeding months. The month number in B11 is entered as '1.' The principal in B12 is obtained from B2. The month number for Month 2, B14, is calculated by adding one to the value in B11. The principal in B15 is the amount calculated in D13. The same pattern occurs for Month 3, B17 adds one to the value three cells above.

The value in B18 is from the cell two up and two right. This is describing relative cell addresses. How many cells away in each direction is the cell from which to get a value?

Example 3

```
    [        A        ][   B    ][   C    ][   D    ]
  1-MONTHS                    36      -36
  2-PRINCIPAL               8500 .6886237
  3-INTEREST RATE           .125 29.89213
  4-                   ---------
  5-PAYMENT/MO.         284.3558 284.3558
  6-
  7-TOTAL PAYMENTS      10236.81
  8-
  9-INTEREST PAID       1736.809
 10-
 11-MONTH                      1
 12-START PRINCIPAL      8500.00 INTEREST     88.54
 13-PRINCIPAL PYMT        195.81PRINCIPAL   8304.19
 14-MONTH                      2
 15-START PRINCIPAL      8304.19 INTEREST     86.50
 16-PRINCIPAL PYMT        197.85PRINCIPAL   8106.33
 17-MONTH                      3
 18-START PRINCIPAL      8106.33 INTEREST     84.44
 19-PRINCIPAL PYMT        199.91PRINCIPAL   7906.42
```

Another type of cell addressing is fixed addressing. The interest rate is in B3. Whenever we need the interest rate, we always go to that cell. Likewise, the monthly payment is in B5; we always go to that cell for it.

If we replicate cells with formulae to enlarge our spreadsheet so it will produce interest and principal for the full term of the loan, *DynaCalc* will display the formula in each cell and move the cursor to the first cell reference and ask (S)ame or (R)elative. If we want fixed addressing, we press the 'S' for same cell displayed. More likely than not we will be dealing with relative addressing and strike the 'R.'

In Example 3, the payment amount and interest come from fixed address cells and we enter 'S' for them when asked. Two data pieces, the last month number and the outstanding principal, come from the previous month and relative addressing is required to get them. Finally, the amount of interest and the principal payment for the particular month are relatively addressed within the lines for that month.

When the replicate is complete, the actual cell numbers are shown in the equations. *DynaCalc* used the (S)ame or (R)elative information you entered to calculate the right cell address to use.

The *Elite*Calc* Copy command works in a similar manner. I really like the way *Elite*Calc*'s copy works; it can deal with blocks rather than only columns or cells. You need to tell *Elite*Calc* if you want to adjust some of the formulae for relative addressing by choosing the Q=QUERY option. It then stops at each cell reference to ask if you want that cell reference adjusted for relative addressing. If you press ENTER at the system prompt, OPTIONS (V,N,Q), all references are adjusted for relative addressing. Press 'N' and none are. 'V' copies only the values in the cells, but not the formulae that created those values.

When using the *Elite*Calc* Copy command, you may specify a single cell or a range of cells to copy. For example, you could copy A14:D19 to A20 to get calculations for months 4 and 5. When *Elite*Calc* asks OPTIONS (V,N,Q), press 'Q,' then answer 'N' to adjust cell references B3 and B5, and 'Y' to all others. Next, copy A14:D25 to A26 to calculate months 6 through 9, and so on.

DynaCalc's replicate is similar except you cannot replicate a block. To accomplish the block move we just discussed, you need to replicate columns A, B, C and D separately. That's more work in this case, but in other cases, *DynaCalc* lets you replicate a single cell to a range of cells, all in a row or a column. Furthur, you can replicate a column or row of cells to multiple columns or rows.

Now, if we had the features of *Elite*Calc*'s Copy and *DynaCalc*'s Replicate combined into one command, wow! *VIP Calc*'s Replicate is just like *DynaCalc*'s, except the program asks "Relative Y/N" for each cell reference.

To wrap up this month, I want to point out a new version of *Elite*Calc* has come out to run with PBJ's *Word-Pak* with an 80-character screen. One owner I spoke with is very pleased with the program; it offers a number of upgrades and changes, most important of which is the inclusion of vertical and horizontal windowing. A borders option to provide column and row identification on printed spreadsheets is also available. The new Zap command will blank all cells containing numbers while preserving formulae and text. This may be neat for blanking out all values from a shell you are developing. But, be careful, this will wipe out constants, LOOKUP tables and the like. The disk is copy protected with a backup copy provided in the package. Check out the ads in this RAINBOW for price and availability.

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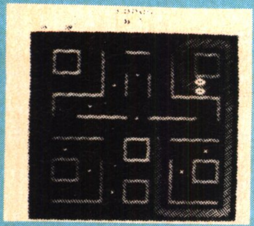

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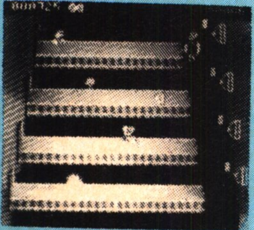

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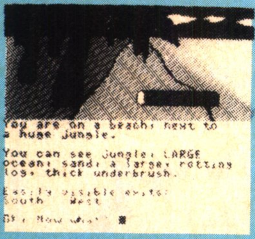

```
You are on a beach; next to
a huge jungle.

You can see jungle, LARGE
ocean, sand, a large, rotting
log, thick underbrush.

Easily visible exits:
South   West

>, Now what? ▮
```

BLACKBEARD'S ISLAND

A brand new high res graphic adventure. This one will blow your socks off! Wander around Blackbeard's Island being ever mindful of the hazards while your lust builds for Blackbeard's buried treasure. T'aint easy, matey!

REQUIRES 32K   DISK ONLY
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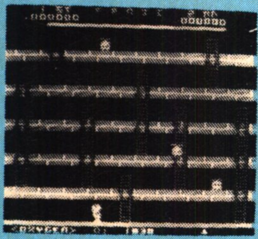

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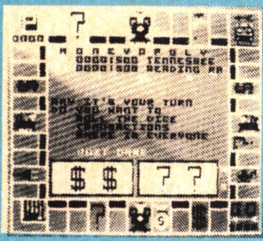

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Now! Play this popular board game on your computer. Probably the most realistic computer board game simulation ever. Contains all the features of the original. Buy, rent or sell properties and become a wealthy land baron with this program.

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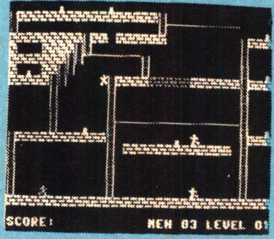

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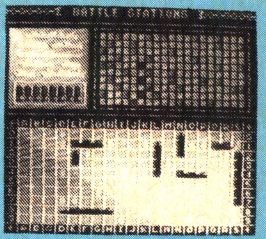

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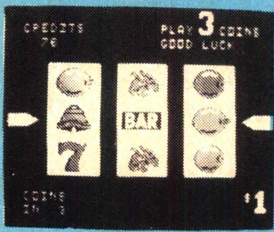

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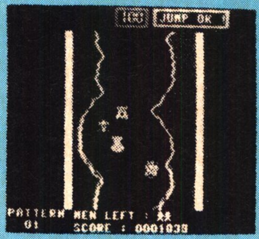

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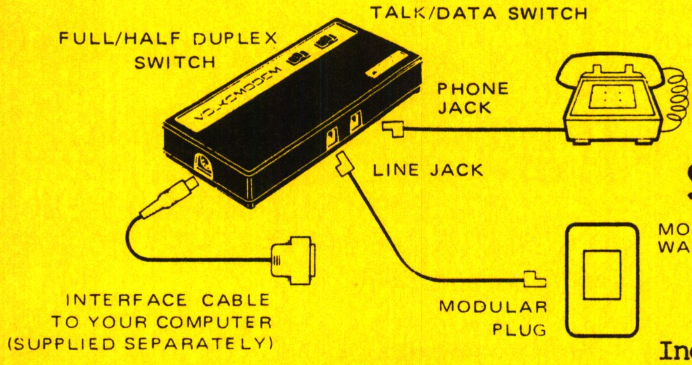

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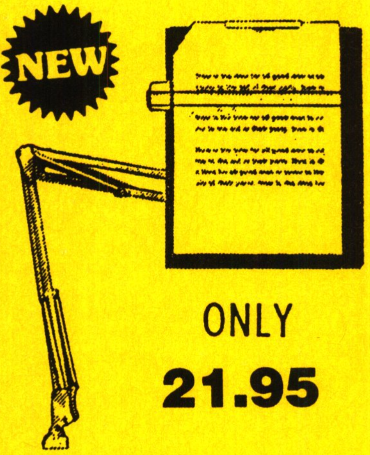

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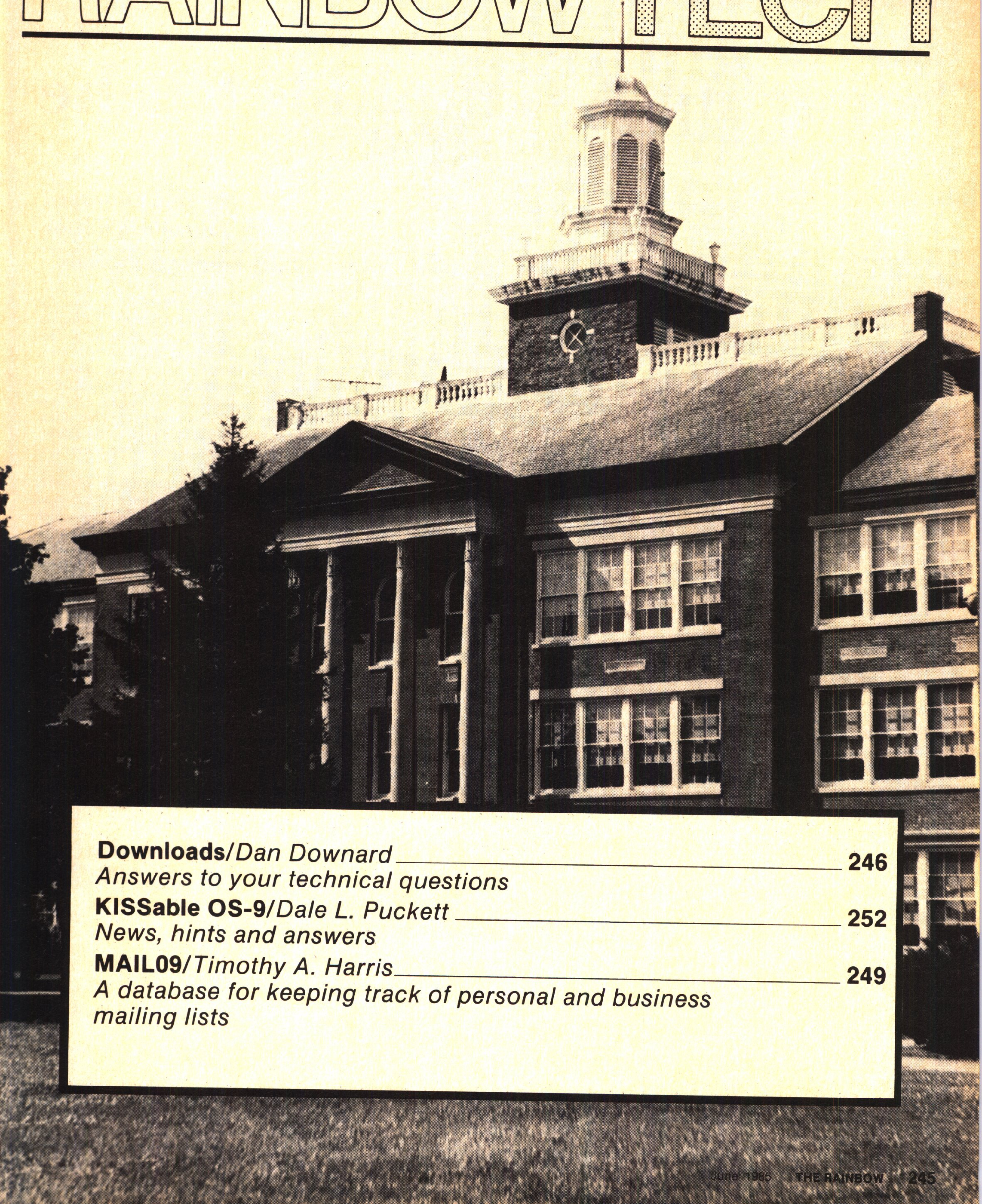


Downloads/*Dan Downard* 246
Answers to your technical questions

KISSable OS-9/*Dale L. Puckett* 252
News, hints and answers

MAIL09/*Timothy A. Harris* 249
A database for keeping track of personal and business mailing lists

RAINBOWTECH

DOWNLOADS

Securing A Graphics Cache

By Dan Downard
Rainbow Technical Editor

• *I am working on a program to draw pictures on my computer that I can recall on my cassette for later use with other programs. My problem is within the realm of getting the same picture after I have stored and recalled graphics pages one to four and the* PMODE, SCREEN, *foreground color and background color. I own a 64K Color Computer.*

Greg Arnold
Xenia, OH

Greg, your question is a very hot topic due to the popularity of several new graphics programs on the market. The immediate answer to your problem is quite simple. Assuming your graphics screen has been saved as a binary file starting at $E00, the default address for Extended BASIC graphics memory, just run the following BASIC program.

```
10 PMODE X,X:SCREEN X,X
20 (C)LOADM"FILENAME"
30 GOTO 30
```

The variables of 'X' describe the graphics mode from which the picture was saved. This program appears in the *CoCo Max* manual as an example of displaying the PMODE4,1:SCREEN1,1 screen necessary for artifacted colors.

Let's go a little further, though, Greg. If you are interested in accessing graphics screens from machine language, how do you duplicate the PMODE and SCREEN commands? The inputs for the VDG are bits three through seven of U4, a 6821 PIA at address $FF22.

To experiment with the different graphics modes not available with the PMODE command, you need some information on the VDG. This information is in the *TRS-80 Color Computer Technical Reference Manual* and also in Section IV of the older *Getting Started With Color BASIC* manuals. This information can be summarized as follows:

$FF22-Bit 3	CSS
$FF22-Bit 4	GM0 & INT/EXT
$FF22-Bit 5	GM1
$FF22-Bit 6	GM2
$FF22-Bit 7	A/G

All of the new graphics programs are really fun to play with, but compatibility of the information is a real problem. The above information is the basis of converting files from one system to another. Of course, the address of the graphics screen is different for all of the programs also, and has to be converted from one program to another.

Good luck, and if you come up with any good screens, send them to us and we'll publish them in the "CoCo Gallery."

(Dan Downard is an electrical engineer and has been involved in electronics for 25 years through ham radio [K4KWT]. His interest in computers began about six years ago and he has built several 68 XX systems.)

CHIP CHANGE

• *I have a 64K 'E' Board CoCo 1. About three weeks after installing 64K, my computer locked up. Pressing Reset or on/off results in columns of inversed @'s and spaces, and I cannot control the computer. Occasionally, turning the computer off for a long period of time then turning it on and hitting Reset a few times will clear the screen and return everything to normal. But, after two minutes, the computer locks up and the whole thing starts over.*

I noted that removing the 6809 chip and turning on the computer results in the same screen pattern. Is my 6809 overheating and going bad?

Steve Powell
Cochrane, Ontario

Normally, garbage on the screen tells me that you have a bad memory chip, Steve. Get one spare chip and start swapping out the chips on a one-by-one basis. If this doesn't work, try the SAM and 6809 chips.

WRITE-PROTECT PROTECTION

• *For floppy disks in general, and for Radio Shack drives specifically, I'd like to know if there is a possible failure mode that could ruin a disk that has a write-protect sticker installed. I use library disks to consolidate utility software for transfer to other disks and because copies of these programs exist on a variety of other disks, I do not want to back up these library disks. But, I do not want to lose these convenient sources of utilities, either.*

Also, I have some purchased software, such as DynaCalc, *that comes on a master disk that cannot be duplicated from which runnable copies are created. I'd like to know what dangers exist — other than handling and dirty heads — that could ruin a write-protected disk.*

Dennis Page
Hawthorne, CA

According to schematics of the CoCo disk system, the write-protect switch in your drive is connected to an input on the WD1793 inside the disk controller interface. According to Western Digital, the manufacturer of the WD1793, "a logic low terminates the command and sets the Write-Protect Status bit."

This sounds pretty safe, doesn't it? There are other problems associated with lost data on disks, Dennis. If you maintain these disks for archival purposes, I don't think you will have anything to worry about. But if you use them everyday, just as you mention, head wear and handling in general could cause problems.

For programs you use a lot, it pays to have a backup.

WANTS DISK AND UPPER RAM, TOO

• *I have an 'E' Board CoCo with Extended* BASIC *1.1 and Disk* BASIC *1.0. It was upgraded by Radio Shack to 32K and by me to 64K. I have a 64K Boot provided by Skyline Marketing with the 64K upgrade as well as one from* THE RAINBOW. *I can* *open the upper RAM when the disk controller is not installed and access it. But with the controller in my place, it will not access normally. If I run a program to poke consecutive numbers into a byte of upper RAM, I get the following result:*

Before Poke	# Poked	After Poke
2	0	0
0	1	0
0	2	2
2	3	2
2	4	0
0	5	2
2	6	2
2	7	2
2	8	0
0	9	2

I would like to be able to use upper RAM with the disk. Can you help?

Richard E. Hawley
San Francisco, CA

Richard, you didn't mention what addresses you were poking. If they are above $FF00, you will not be able to read what you wrote, or PEEK what you POKEd, as this is the area of memory reserved for SAM registers. Try some addresses between $E000 and $FF00.

THE ENVELOPE, PLEASE

- *Can you tell me where I can get a schematic diagram and maybe a service manual for the Disk Controller 1 Card? Do you know where I can get a disassembled listing of the Disk 1.0 ROM and a good disassembler? And also, how does the 6809 CPU know that the Disk Controller Card is connected on power up when the cartridge select pin on the card is not used?*

Rick Thorne
East Keansburg, NJ

Rick, I am going to nominate you for an award for the most questions in the shortest letter! Unfortunately, the answers are not going to be that short.

Radio Shack publishes a service manual for the Color Computer Disk Interface. Ask your dealer for a service manual, Catalog No. 26-3022.

Spectral Associates published a ROM dissassembly entitled *Disk BASIC Unravelled.* The set consists of three books, one each for Color BASIC, Extended BASIC and Disk BASIC. If you care to try yourself, there are several disassemblers on the market. Two I am familiar with are the Micro Works' *80C* and Computerware's *Super Sleuth.* Of course, *EDTASM+*, from Radio Shack, has a disassembler as part of ZBUG.

Address $80A6 of the Extended BASIC ROM checks the first two memory bytes at address $C000, the beginning of the Disk BASIC ROM. If they are correct, Extended BASIC assumes a disk ROM is installed and jumps to the disk ROM for initialization.

RPM OVERLOAD

- *On Page 238 of the September 1983 RAINBOW, Dan Downard states he will address the subject of adjusting the CoCo disk drive RPM in the October issue. I've looked in every issue since September 1983 and cannot find it.*

I've been using OS-9 for three months with no problems until now. All of a sudden my disks spin at 307.8 RPM which is beyond OS-9's specifications. Is this speed something I can adjust myself and how, or do I have to support Radio Shack again? I await with baited chips.

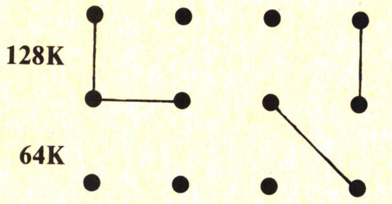
Rick L. Earsley
Elgin, IL

Rick, I had a problem finding it myself. On Page 294 of the November 1983 issue you will find a picture explaining the calibration procedure.

For those of you who don't have this issue we will try to explain the procedure. On the older TEAC drives, there is a yellow potentiometer on a circuit board at the front left of the disk drive. This pot controls the speed of the drive. While under a fluorescent light, or using a speed checking program, adjust this pot for 300 RPM.

- *The following diagram shows how to install a 27128 EPROM on the latest CoCo 2 single ROM, two-RAM Board.*

Jump across J1 (an address line), then follow this diagram for jumpers J2, J3, J4 and J5:



Jump Pin #1 to Pin #27 on EPROM

Douglas Cook
W. Jordan, UT

Thanks, Doug. I'm sure there are quite a few people who will benefit from your hint.

SWITCH HITTER

- *I am the owner of a 64K Color Computer ('D' Board). I have installed my disk controller inside my computer and wired it all into the circuit board (works just super, cleared up a lot of problems), but this created a problem I can't figure out. I'd like to know if it is possible to put a switch somewhere to detach the Disk BASIC and if it is, where would I put it? I would like to be able to just flip a switch to disable it, as I would like to use ROM packs at the odd time.*

Ralph Hansen
Nelson, British Columbia

I would suggest installing a switch in the CE line of the ROM. This would disable any addressing of the ROM and make your system think you are using Extended BASIC.

KEYBOARD CONNECTION

- *I would like to hook up a typewriter-style keyboard, but they are quite expensive. Could I hook up a cheaper keyboard from a CoCo 2 to my 'E' Board CoCo?*

Mary Darr
Grand Ledge, MI

Mary, the only problem with using a CoCo 2 keyboard is the connector is different. There are adapters made for this purpose. Radio Shack supplied these adapters with their keyboard upgrade kits, so ask your local service rep where you can order one.

BASIC BOOBY-TRAP

- *I am a SYSOP of a BBS and my problem is that when the computer finds an error, it throws the caller into BASIC. Do you happen to know of a way to achieve an* ON ERROR GOTO *statement?*

Gary Wright Jr.
Huntsville, AL

One solution that comes to mind, Gary, is to use a program called *Superscreen* by Mark Data Products. It supports full error trapping in Disk BASIC. There are several other ads for programs that add error trapping to BASIC, along with a few suggestions in recent RAINBOW articles.

CURSOR CURSES

- *Is it possible to reduce the size of the blinking cursor on the CoCo? There are times when it becomes distracting.*

Norman L. Garton
Joliet, IL

Norman, try the following: POKE &HA1A6,0 — my cursor disappears. The routine for blinking the cursor is located at $A199 in your Color BASIC ROM.

Your technical questions are welcomed. Please address them to: Downloads, THE RAINBOW, P.O. Box 385, Prospect, KY 40059. We reserve the right to publish only questions of general interest and to edit for space and clarity. Due to the large volume of mail we receive, we are unable to answer letters individually.

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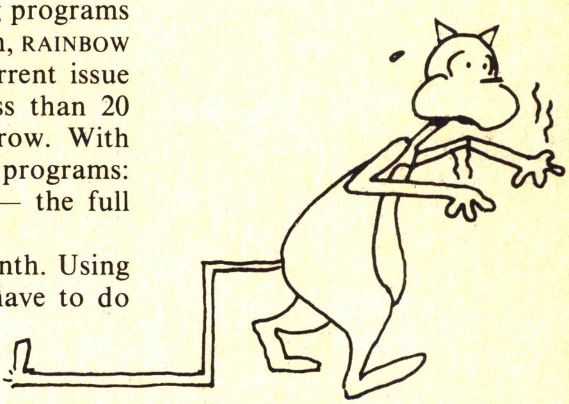

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If you're among many readers of THE RAINBOW who file every issue of the magazine, expecting someday to need a program or article contained within the magazine, past releases of RAINBOW ON TAPE are available — beginning with the April 1982 edition (Please check this issue's Table of Contents for "Back Issue Information" to review previous magazine themes).

Music From Past Printer Issues:

June 1984 — Our first Music Issue featured such classics as Tchaikovsky's "1812 Overture," Bach's "Toccata in D Minor," Handel's "Hornpipe," and Kuhlau's "Sonatina," as well as such sentimental favorites as "I'm Looking Over a Four-Leaf Clover" and "The Entertainer." Also: Larry Konecky's innovative 12-tone composition program which is an alternative to traditional methods of creating music pieces, a BASIC program which loads a machine language music synthesis program for entry, editing and playing of music, and tutorials to help you become familiar with the location and functions of piano keys and guitar strings. Plus, a variety of games and graphics programs.

Other Issues — Our **December 1983** issue contained Larry Konecky's "CoCo Composer," a program that makes it possible for you to compose in four-part harmony. It also included eight of the most popular Christmas carols of all time. Our **December 1984** issue included seven more holiday favorites (plus the winning entries in last year's Adventure Contest). Our **November 1983** issue featured Bach's "Sinfonia."

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Look for the order card between pages 34 and 35 in this issue.

To order by phone, call: (502) 228-4492

OS-9 UTILITY

This database program keeps track of two separate mailing lists — a personal list and a business list

MAIL09

By Timothy A. Harris

Many persons who have purchased the OS-9 operating system and the BASIC09 language from their Radio Shack dealers have found themselves with a very powerful system and not a lot of software to run on it. *MAIL09* is a piece of software to help fill part of the need.

MAIL09 is a database program which keeps track of two separate mailing lists — one a personal list and a business list. It is menu and prompt driven, and thus is very easy to use. It also contains operations not found in many similar programs such as the ability to not only make labels of all the addresses you have, but also to make multiple mailing labels of a single entry. This is nice if you don't like to write return addresses all the time — just run off a few hundred labels and you're set.

MAIL09 also uses an indexed file structure so you can locate an item quickly and the mailing list is always sorted alphabetically for you via a bubblesort routine run on the index.

The two mailing lists can each be up to 100 entries long as currently implemented and each entry contains up to 10 fields. These fields are a company name for the business list, a last name, first name, title, two address fields, city, state, ZIP and phone. The last name is used to index the personal list and the company name is the index key for the business list. These two fields can contain up to 25 characters: the first name up to 10, the title up to four and the address fields up to 32. The city can have up to 15 characters, the state up to 10 if you don't like to abbreviate, the ZIP code can be up to 10 characters long for the new nine-digit ZIPs, and the phone can handle 14 characters for area code and number in a format of (XXX) XXX-XXXX.

MAIL09 is written in BASIC09 which is an ideal language for implementation of application programs in the OS-9 environment. One major advantage of BASIC09 is the use of user-defined TYPE declarations like PASCAL which allow the label (that includes the above fields) to be a single data item.

Another advantage of BASIC09 is its modularity; the total code for *MAIL09* is very large, too large, in fact, to run on the CoCo with OS-9 if it is all in one big chunk of code as regular Microsoft BASIC programs are, but BASIC09 allows one to make programs in separate modules and have these modules loaded as needed from disk when they are called from another module. The modules communicate with each other via the parameters they pass.

If you look at the code, you will notice there are four main parameters used: label, index, listfile and indexfile. Since the label is only used within a given procedure, it need not be passed as a parameter and could be declared by a DIM statement in each procedure that needs to read or write an entire label. This approach, however, takes up a lot of space since the label uses up quite a chunk of memory.

I chose to save on this memory use by declaring the label only in the first procedure and then passing it to all others as a parameter, making only the main procedure save the memory for the label and then all the others need only save the address of the label to access it.

The index array is also passed around for similar reasons. The listfile and indexfile are the actual names of the data file you will be using, and let you

---

(Tim Harris has a bachelor's degree in computer science and is employed as a software engineer. Several of his programs have also been featured in the "KISSable OS-9" column of THE RAINBOW.)

work with two separate lists and still have only one index file in memory at any given time.

I would like to make a few technical notes first before I actually get into the operation of the *MAIL09*. First of all, the program requires a Hi-Res screen to run, such as those found in *O-Pak* or that obtained by the PBJ *Word-Pak*. The standard display of the Color Computer will just not work; the menus would be too large to fit on a single screen.

I used the 64 by 19 display of *O-Pak* to write the program, but the 51 by 24 would work just as well, and an 80 by 24 would be great. The use of *O-Pak* gives a nice display at the cost of memory — lots of it — which further limits the memory available with BASIC09. BASIC09 needs about 22K to load and *O-Pak* takes up another 6K or so, leaving about 7-8K of workspace in BASIC09. I can get a workspace of 9983 with BASIC09 and *O-Pak* installed, but only after eliminating several device descriptors and drivers from my boot file.

Due to these constraints, the program will not run within BASIC09 itself, but needs to run PACKed with the *RUNB* package in memory. The use of the KILL statement after RUNing a procedure helps conserve memory space also, by unlinking the data space used by that procedure. The program modularity also has its drawbacks, although it allows a large program to run in limited memory, it does this by leaving things on the disk until they are actually needed, making a program access the disk drive a lot during execution.

If you have standard Radio Shack drives tracking at 30 ms, this can cause delays, so it is best to have your drives tracking as fast as they can (mine go at six ms and there is not much delay in the program execution). For hints on how to make your drives work faster or how to get rid of unwanted device descriptors and drivers, look into some of the past issues of RAINBOW at the "KISSable OS-9" column.

MAIL09 consists of 21 separate procedures which are PACKed into 15 modules; to get it up and running on your system, it's best to have a disk set up with a CMDS (Commands) directory for *RUNB*, the program modules and any system utility you might want, mainly dir and del.

If you have a single disk system, you would also want to put BASIC09 in the CMDS directory so you could edit the programs and put the sources in a separate SOURCE directory before PACKing them to the CMDS directory. Remember, you cannot turn PACKed I-Code back to BASIC09 source code if you have to edit it, so always SAVE the source code first.

I also set up a separate DATA directory to hold the files generated by the program and use it as the data directory while running the program.

When entering the code, I chose to PACK those procedures common to all of the program into the main module. Thus, enter the code for the modules mail09, clearscreen, entryerror, getindex, printlabel and inputdata all into the workspace at one time, then use "run mail09" or "list mail09" to get that to be the current module, and SAVE*

The listing:

```
PROCEDURE mail09
TYPE labeltype=companyname:STRING[25]; title:STRING[4]; lname:STRING

[25]; fname:STRING[10]; address1:STRING; address2:STRING; city:STRING

[15]; state:STRING[10]; zip:STRING[10]; phone:STRING[14]
TYPE indextype=name:STRING[25]; number:BYTE
DIM label:labeltype
DIM index(100):indextype
DIM ciname,piname:STRING[6]
DIM clname,plname:STRING[5]
DIM resp:BYTE
ciname:="cindex"
clname:="clist"
piname:="pindex"
plname:="plist"
LOOP
RUN clearscreen
PRINT "                     MAIL09"
PRINT "               List Selection Menu"
PRINT "               ====================="
PRINT
PRINT "             1 — Work on Personal List"
PRINT "             2 — Work on Buisiness List"
PRINT "             0 — Exit to OS-9"
PRINT
INPUT "                  Selection : ",resp
EXITIF resp=0 THEN
RUN clearscreen
ENDEXIT
IF resp=1 THEN RUN mainmenu(label,index,plname,piname)
ELSE IF resp=2 THEN RUN mainmenu(label,index,clname,ciname)
ELSE RUN entryerror
ENDIF
ENDIF
ENDLOOP
END
PROCEDURE clearscreen
DIM clearcode:STRING[1]
clearcode:=CHR$($0C)
PRINT clearcode
END
PROCEDURE entryerror
DIM resp:BYTE
PRINT
PRINT "                  Illegal Selection"
PRINT "                Hit any key to Continue"
GET #0,resp
END
PROCEDURE getindex
TYPE indextype=name:STRING[25]; number:BYTE
PARAM id:INTEGER
PARAM index(100):indextype
PARAM numentries:INTEGER
numentries:=0
WHILE NOT(EOF(#id)) DO
numentries:=numentries+1
GET #id,index(numentries)
ENDWHILE
```

them and PACK* them into the SOURCE and CMDS directory. The '*' will make all the procedures go into a single module called mail09. The mailsort and xchange procedures should be similarly SAVE*ed and PACK*ed into a module named mailsort.

All the remaining procedures should be PACKed individually into separate modules making for 15 modules and 21 procedures. If you follow this procedure, you should be able to run the program by getting out of BASIC09, making sure your execution directory is CMDS and the data directory is DATA, then typing "mail09" which will bring up *RUNB* and the main module of the program.

Once you get the program up and running, the actual use of it is simple. The entire program is menu and prompt driven, so it tells you or asks you what to do at every step of the way. You are first asked if you want to work on your personal or business list, both of which can contain up to 100 entries. Also on the selection menu is the option of zero (to return to OS-9); throughout the program the option of zero will return you to the previous level of the program.

After selecting a list to work on, you will go to the main menu where you can 1) create the list; 2) update the list; 3) display the list to the screen; 4) print the list to the printer; 5) print mailing labels (the program is set up to use one wide fanfold labels that are 3½ inches wide and 15/16 inches high; 6) print individual labels and make multiple copies of a single label; 7) execute a Shell command; and 0) return to the selection menu. If you choose to update the list, you will see the update menu which allows addition of entries, alteration of an entry and deletion of an entry. At all times you will be told what exactly to do or given a menu to decide from, so the program is very user friendly.

I hope *MAIL09* helps to bridge the gap of availability between having a powerful operating system and having some powerful software to run on it. The source code is rather long and does take some time to type it all in, but the BASIC09 editor makes it an easier and faster job by automatically capitalizing for you and doing a lot of error checking as you type.

(You may contact Mr. Harris with any questions about this program at 6620 Forest Court, Des Moines, IA 50311, phone (515) 274-2393.)

```
END
PROCEDURE printlabel
TYPE labeltype=companyname:STRING[25]; title:STRING[4]; lname:STRING

[25]; fname:STRING[10]; address1:STRING; address2:STRING; city:STRING

[15]; state:STRING[10]; zip:STRING[10]; phone:STRING[14]
PARAM path:INTEGER
PARAM label:labeltype
PARAM dophone:BOOLEAN
DIM numlines,i:INTEGER
numlines:=0
IF label.companyname<>"" THEN PRINT #path,label.companyname
numlines:=numlines+1
ENDIF
IF label.title<>"" THEN PRINT #path,label.title; " ";
ENDIF
IF label.fname<>"" THEN PRINT #path,label.fname; "  ";
ENDIF
IF label.lname<>"" THEN PRINT #path,label.lname
numlines:=numlines+1
ENDIF
IF label.address1<>"" THEN PRINT #path,label.address1
numlines:=numlines+1
ENDIF
IF label.address2<>"" THEN PRINT #path,label.address2
numlines:=numlines+1
ENDIF
PRINT #path,label.city; ",  "; label.state; "  "; label.zip
numlines:=numlines+1
IF dophone THEN
PRINT #path,label.phone
numlines:=numlines+1
ENDIF
FOR i:=numlines TO 5
PRINT #path
NEXT i
END
PROCEDURE inputdata
TYPE labeltype=companyname:STRING[25]; title:STRING[4]; lname:STRING

[25]; fname:STRING[10]; address1:STRING; address2:STRING; city:STRING

[15]; state:STRING[10]; zip:STRING[10]; phone:STRING[14]
PARAM label:labeltype
PARAM listfile:STRING[5]
PARAM alldone:BOOLEAN
alldone:=FALSE
IF listfile="plist" THEN
label.companyname:=""
INPUT "Last Name           : ",label.lname
IF label.lname="" THEN
alldone:=TRUE
ENDIF
ELSE
INPUT "Company Name        : ",label.companyname
IF label.companyname="" THEN
alldone:=TRUE
ELSE
INPUT "Last Name           : ",label.lname
ENDIF
ENDIF
IF NOT(alldone) THEN
INPUT "First Name          : ",label.fname
INPUT "Title               : ",label.title
INPUT "Address 1           : ",label.address1
INPUT "Address 2           : ",label.address2
INPUT "City                : ",label.city
INPUT "State               : ",label.state
INPUT "Zip Code            : ",label.zip
INPUT "Phone Number        : ",label.phone
ENDIF
END
```

KISSable OS-9

News, Hints And Answers

By Dale L. Puckett
Rainbow Contributing Editor

We don't have a lot of news this month, but we have more questions to answer. We'll start with a load of hints and we'll wrap up the column with a number of interesting BASIC09 procedures from several readers.

First, I stumbled upon a long thread where members were discussing the merits of several alternatives to Tandy's CCDISK module and learned about a new driver we haven't mentioned before. MJS Software (3121 Sea Lane, Bremen, IN 46506, (219) 546-4009) offers a CCDISK that reportedly does an excellent job handling 80-track, double-sided drives.

A lot of the coding was done by an OS-9 pioneer, Carl Kreider. Carl is one of the leading contributors to the OS-9 Users Group's software library and is very knowledgeable. If you call MJS, tell them they should have let us know about it sooner! That goes for anyone producing OS-9 software . . . tell us and we'll tell the world in "KISSable OS-9."

We mentioned recently that several readers were interested in running OS-9 on the Dragon computer; while reading the SIG, we noticed that Jim Omura had left the company's address: Dragon Data Ltd., Kenfig Industrial Estate, Margam, Port Talbot, West Glamorgan, SA13 2PE. Should be a good place to write for Dragon information.

Speaking of addresses, Jonathan C. Keatley left the following for the Dragon's 6551 ACIA:

$ff04 — Receive/Transmit Data
$ff05 — Status Register
$ff06 — Command Register
$ff07 — Control Register

Jonathan also left a four-line BASIC program that emulates a dumb terminal. If you have one of the new RS-232 Paks and the new version of OS-9 with the *ACIAPAK* drivers, you should be able to emulate it nicely in BASIC09. When you do, you'll need to use the corresponding addresses for the RS-232 Pak's registers. See the *SysType* listing later in this column or look in the device descriptor for /T2 to find the base address of the RS-232 Pak's ACIA. Here goes!

```
10 POKE &HFF06, &H6B : POKE
   &HFF07, &H36
20 Y$=INKEY$ : IF Y$<> "" THEN
   POKE &HFF04, ASC(Y$)
30 IF PEEK (&HFF05) AND 8 THEN
   PRINT CHR$(PEEK(&HFF04));
40 GOTO 20
```

Software Library News

You've probably had a chance to peruse the complete listing of the OS-9 Users Group's Software Exchange Library in the May RAINBOW. Here's some more good news. The list you read was complete as of February 1, 1985. I've learned that 10 more disks have already been added to the list. We'll try to get it compiled for you in a future RAINBOW. Dave Kaleita, the group's software librarian, has sure been busy.

MOTD, the group's newsletter, has picked up a new contributing editor. Hubert "Bert" Schneider in Omaha, Neb., has signed on to write a regular

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(Dale L. Puckett is a free-lance writer and programmer who has worked with the Motorola family of microprocessors since 1976. He is the author of The Official BASIC09 Tour Guide, *published by Microware and* The Official Rainbow Guide to OS-9, *published through the Rainbow Bookshelf. He serves on the InfoWorld Software Review Board and is a chief warrant officer in the U.S. Coast Guard.)*

Incredible!

4 User 68000

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Terminal not included.

Multi-User!

Frank Hogg Laboratory announces their Quad Terminal (QT) series of multi-user computer systems, designed to run Microwares new OS-9/68000 operating system. The QT offers 32 bit processor power in a compact integrated package that requires only a terminal to operate.

The QT hardware features: 68008 processor running at 8 Mhz, 128K bytes expandable to 512K bytes, an interval timer for time sharing, 4 serial ports with selectable baud rates from 300 to 19,200, 2 centronics compatible parallel printer ports. Supports 2 double sided double density 96 tpi floppy disk drives and a SCSI (SASI) bus interface for Winchester disk drives. The QT is available as a single floppy (1), a dual floppy (2) or as a single floppy and a 10 or 20 megabyte hard disk (HD). Size 5 1/2 high, 11 1/2 deep, 9 1/2 wide. Can be mounted vertically or horizontally.

Software Included!

SOFTWARE included is OS-9/68000, the 68000 version of the proven OS-9 operating System that is both disk and file compatible with standard and Color computer versions of OS-9. Basic09 is the 68000 version and is source compatible with the 6809 version. DynaCalc is the 68000 version of the proven 6809 spreadsheet. Stylograph is the 68000 version of the popular 6809 word processor. Mail merge and speller are the 68000 versions of those programs. Programming tools included are a relocating macro assembler with linkage editor, screen and line editors, and an interactive debugger. The software has a retail value in excess of $2000 and is INCLUDED free! Programming languages available and under development include C, Pascal, Fortran and Sculptor.

A Hellava Deal!

The QT is available in four basic configurations. Other configurations are possible and are available. Call for price.

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128K, single 96tpi double sided floppy and all software **$1595.00**

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Note: The QT can hold 2 half height drives internally (floppy or hard). Provision has been made for hooking up external floppy drives. This allows using large capacity full height hard disk drives in the QT case with floppy drives in another case. You can boot from the hard disk so floppys would only be necessary for program transfers and backup. Removable hard drives are also available. Call or write for complete specifications and prices.

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770 James St., Syracuse, New York 13203

315/474-7856

column about the OS-9 Users Group's Software Exchange Library. He'll be highlighting software in the library and reviewing it for you. I received *MOTD* number five recently. It looked great and featured an excellent overview of OS-9 from Greg Morse, plus at least a dozen other good articles.

But, the group's new editor, Tim Grovac, is already preparing another issue. We quote: "I need some more articles for *MOTD*. Become famous instantly! Help support your Users Group! Certainly there must be something you all are doing with your computers that others would like to hear about." Send disk or printed copy to:

MOTD Publishing
25825 104th Ave. SE
Suite 344
Kent, WA 98042

We still keep getting letters here at THE RAINBOW asking how to join the OS-9 Users Group. Once again, here's the address.

OS-9 Users Group
P. O. Box 7586
Des Moines, IA 50322

You may use this address either for information or to join. To join, simply enclose a check for $25 — one year's dues — and state the name of the computer you own and the type of disk drives you use so you will receive your copy of Users Group Disk #0 on a disk of the right format. Make sure you include your correct address and include your CompuServe number if you have one.

Joe Dubuc, chairman of the Membership Committee, has received many requests for information about local users groups. People want to know where they meet and how to form one. Please send Joe information about any groups you know about. Give him the group's name, its main interest, the name of a contact person, the group's BBS number, its meeting place and the date and time of its monthly meetings. Here's the address.

OS-9 Users Group Membership
Committee
13229 Blue Quail Rd.
Yukon, OK 73099

New OS-9 Machines

Since the rumor mill has decided that Tandy won't release a new Color Computer until 1986, I found this note from Steve Sampson interesting.

If you are interested in a high performance OS-9 machine, please contact Jack Gerblick, 1945 Gallows Road, Suite 305, Vienna, VA 22180. It seems Fujitsu is thinking about selling its 68XX(X)-based machines here in the states.

In Steve's words, "The FM-11 is a simply astonishing dual 6809-based machine with very good color graphics and OS-9/6809 Level Two. In my opinion, it blows away a Macintosh, even without the 68000 board that can be installed in it. The FM-77 is another dual 6809 machine that starts smaller than the FM-11 but is expandable. The FM-16, in its Japanese incarnation at least, is a 68000-based computer."

Anyone who attended either of the last two Microware Seminars in Des Moines can vouch for Steve's description. They were pretty slick. The bottom line? I guess it's up to us — today's OS-9 pioneers — to convince Fujitsu they need to invest in the U.S. market. You've got the address; go to it.

Here's a tip from John Schira that may help solve your problems with *ACIAPAK* and /T2 in OS-9 Version 1.01. John believes the people who aren't having any trouble are using smart modems. Conversely, he feels if you are using a dumb modem — a Radio Shack Modem I, for example — you're probably having trouble making this combination work right. The reason?

"Smart modems leave the carrier detect signal between the computer and the modem high — or on — so the computer can send commands to the modem while it is offline. I've found that /T2 and *ACIAPAK* work consistently well as long as this signal is present," he said. "Without this signal, they won't work. The solution is to try jumpering pin 8. If this doesn't work, try pin 6."

Invasion of the Hard Drives? Maybe!

I've received about a half-dozen calls about hard disk drives during the past month. It seems like everyone has noticed the price dive the bare drives are taking and are hoping some enterprising entrepreneur will come out with a system for their CoCo. I saw one working at Irvine, but the company hadn't announced it yet — they believe in announcing a product when it is ready, not before. When they tell us it's ready, we'll let you know.

The real problem here is the cost of the cables, controller, power supply and everything else it takes to build a complete hard drive system. Another firm designed a system for the Color Computer recently, but will it ever go into production? I doubt it. Why? Even though a manufacturer can buy a five megabyte hard drive for around $100 now, it is still going to cost them around $600 (final selling price) to build a tacky system . . . or $1400 to build one that discriminating computer owners would be proud to own. The question then remains: Is a person who paid $200 for his computer going to spend $600 — or $1400 — for a hard disk system? Probably not!

For the same reason you aren't seeing software houses rush to invest the talent and time necessary to develop new applications software, you probably won't see much new hardware either. Because of the unique marketing strategy used by Tandy (i.e., they only sell their computers in their own stores), a manufacturer can only sell peripheral equipment by mail order. When he does, he may reach 10 percent of the market. To succeed he needs a higher percentage. The software houses are in the same boat, so we all lose. That's life!

This scenario was played out again in a letter I received from Cliff Davis (12714 Burson Drive, Manchaca, TX 78652). It seems that he and Jim Smith have designed a CoCo RAM Disk. The ttl prototype uses 55 chips in addition to four banks of dynamic memory chips and bank select logic to support four additional banks — a total of 512K. It plugs into the bus expander and uses the Color Computer's 'E' and 'Q' clocks for timing. To transfer data, you send a two-byte logical sector address and a function code to the controller. The software includes an OS-9 device driver, device descriptor and a "prep" utility.

So what's the problem? Well, Cliff and Jim have gone to three companies so far. All have said that it looked like a great enhancement for the CoCo, but, they don't believe the market will bear the cost of the finished product. Cliff's alternative is to offer the board as a construction project in RAINBOW. He would like to create enough interest in the design to justify making a PC board. Let him know what you think.

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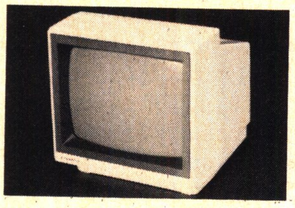

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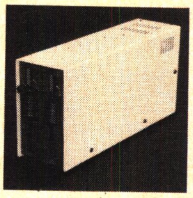

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New Software Newsletter

I talked with Frank Hogg at FHL and learned that his company plans to publish a newsletter for software developers. It's for you if you are developing software for any computer. Regular columns will feature columns for programmers, engineers and yes, even the marketing types. The new publication will be named *SoftNews*.

Frank has been in the software business for several years so he has plenty of experience to share. The price: $24 for 12 issues. The first issue was scheduled to hit the stands in May. After that, it will be published every other month until August when it goes monthly. If you are developing software for any computer or are interested in the software development business, call FHL. By the way, if you are in the business and have a few tips to share, Frank is also looking for writers.

Everyone's Talking about OS-9 68K

Frank couldn't contain his enthusiasm for OS-9 — 68K that is. He had been working with Microware's C compiler on his K System,"QT," and successfully ported many C programs from the OS-9 Users Group Library to the QT.

"All of the C programs that were written in 6809 Microware C compiled the first time in 68000 C and most ran immediately," Frank said. "The only ones that wouldn't run were the ones that were written specifically for the 6809 microprocessor using in-line assembly language code. Some of the C programs written in Introl C would not compile, but this is true for the 6809 C compiler, also."

Frank reported that most of the BASIC09 programs loaded and ran immediately. The only one that wouldn't run was a modem program that used a lot of direct pokes to memory. "It is quite a kick to type `´Basic09 #375375k` and receive a report that you have 388,106 bytes free for programs (in a 512K QT)."

And Frank wasn't the only one excited about OS-9 68K. Rodger Snyder at Great Plains Computing — now named Stylo Software, Inc. — reports that you can edit a file 150 pages long and have it all in memory at one time. Wow! Also, Brian Lantz, author of Computerware's *Databank Manager*, reported that BASIC09 appeared to be almost 100 percent compatible — at the source level — with BASIC09 on the Color Computer. He noticed that a new function, "INKEY #filenumber" has been added along with a "DIGITS" statement that lets you control the number of digits printed from a real number.

More Version 1.01 Notes

John Carter of Smyrna, Ga., who showed you how to personalize your OS-9 prompt several months ago, has been studying the differences between OS-9 Version 1.0 and Version 1.01, and he was good enough to share them with us.

His first tip is that the *OS9Boot* file that comes with the new version is $3607 bytes long compared with $3032 bytes in the original. This means if you use the trick we passed along in the February column to place the CMDS directory at the same location on each disk, you must make sure all of those disks are using the same version of OS-9. If you have different versions the trick will not work, so beware.

Here is a table that shows you a few more of the size differences.

In the CMDS directory:

File	Original Size	New Size
dcheck	$28A0	$27C6
free	$2C1	$2D1
ident	$6CE	$6E7
tmode	$2CF	$2DE
xmode	$380	$38F

In the DEFS directory:

OS9Defs	$4A7A	$54B4
RBFDefs	$11FF	$154E
SCFDefs	$A0F	$E94
SysType	$42	$81

The DEFS directory in the new version has a new file named *defsfile*. This file has been in non-Color Computer versions of OS-9 for several years and simply tells the assembler to use all of the other "defs" files.

If you are a person who delights in trying to stay on top of what Tandy is up to with the Color Computer, Carter suggests you browse through the files in the new DEFS directory. You'll learn that plans really did exist for a "Deluxe CoCo" at one time — study these lines from the new *SysType* file.

```
  ifeq COCOType-Delux
 ACIAType set ACIA6551
 A.T2  set  $FF3C  6551  Acia
Internal
 A.T3 set $FF68 6551 AciaPak
  else
 A.T2  set  $FF68  6551  ACIA
external
  endc
```

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If you browse deeper into the "defs" files you'll also find a hint of OS-9's popularity in Japan — it's second in popularity there only to UNIX. There are references to "kata" and "kanji" and "Hoshi." Think about it — these Japanese characters can be drawn on a high resolution screen just as easily as English letters. Interesting!

BASIC09 Graphics Programs

Carter donated several BASIC09 listings that should really help you learn some of the language's fundamentals. We've had a lot of requests for information about using graphics under BASIC09. Two of John's procedures will really get you started. I was impressed when I ran them.

Gfxtest is a simple routine that draws a line and a series of concentric circles in several background/foreground combinations using print statements. *Screentest* uses BASIC09's "gfx" module to dazzle you with circles and lines in several colors and prints big letters. It also shows you how you can use several of the cursor positioning commands on an alpha screen from within OS-9. Enjoy!

Carter wrote a BASIC09 procedure that emulates the CP/M and MS-DOS Type command. It simply lets you display the printable characters in any file on the terminal. Itype, on the other hand, displays printable characters but, also displays the other characters in the file as a two-digit hexadecimal number. It works a lot like the standard "dump" utility — it's just in a different format.

And finally, his *CoCoDir* lets you read the directory of a Radio Shack DOS disk from within BASIC09. It shows you how you to use OS-9's '@' operator along with BASIC09's SEEK and GET statements to look at any disk.

We received another BASIC09 procedure — *cursor_position* — that demonstrates yet another function from Mark W. Smith of Latonia, Ky. He uses the MOD function to create a window on PBJ's *Word-Pak II* since it does not recognize cursor positions greater than 512 when using the POS function.

Smith also had a question. He mentioned that he was unable to install the *Word-Pak II* drivers properly with Version 1.01 of OS-9. He mentioned that *ACIAPAK* and a few other modules didn't appear in memory after he created a new boot file.

Here's the answer, Mark. Most likely the "install" procedure and the *bootlist*

The listing:

```
procedure elapsed
 REM by Thomas Alan Ring
 REM 75 Market, Apt. #4
 REM 315-265-2808

 REM To start typing "run elapsed("S",et)
 REM To Finish typing "run elpased("F",et)

 PARAM sf:STRING[1]; et:INTEGER
 DIM f,s:STRING[17]
 DIM sc,fs,sm,fm:INTEGER
 DIM sh,fh,sd,fd:INTEGER
 DIM es,em,eh,ed:INTEGER

 ON ERROR GOTO 1

  IF sf="S" THEN
    f=DATE$
    END
  ELSE
      PRINT "Wrong Input Parameter: "
      PRINT "Use S(tart) or F(inish)"
      END
  ENDIF

  sc =VAL(MID$(s,16,2))
  fs = VAL(MID$(f,16,2))
  sm=VAL(MID$(s,13,2))
  fm=VAL(MID$(f,13,2))
  sh=VAL(MID$(s,10,2))
  fh=VAL(MID$(f,10,2))
  sd=VAL(MID$(s,7,2))
  fd=VAL(MID$(f,7,2))

  IF fs-sc < 0 THEN
     fh=fm-1
     fs=fs+60
  ENDIF

  IF fm-sm < 0 THEN
     fh=fh-1
     fm=fm+60
   ENDIF

  IF fh-sh<0 THEN
    fd=fd-1
    fh=fh+24
  ENDIF

   es=fs-sc
   em=fm-sm
   eh=fh-sh
   ed=fd-sd
   et=es+60*(em+60*(eh+24*ed))
  ENDIF
  END

1 PRINT "Probable date/time error: "
   PRINT "Elapsed Time will be wrong. "
   PRINT "Check date, t."
   END


PROCEDURE cursor_positioning
 0000        DIM test_string:STRING[80]
 000C        DIM blank:STRING[1]
 0018        DIM data_inputs,count,data_lines,remainder,zilch:INTEGER
 002F        blank:=" "
 0037        data_lines:=14
 003E        data_inputs:=1
 0045        zilch:=0
 004C        BASE 0
 004E        PRINT CHR$($0C)
 0054        PRINT USING "S80^","Contributed to RAINBOW by Mark W. Smith"
 0087        PRINT USING "S80^","Routine to show one way the MOD function can be
used in cursor positioning"
                                                     ;
 00DE        PRINT USING "S79^","to replace the POS function that WORDPAKII does
not support."
 0126        PRINT
 0128        PRINT CHR$($02); CHR$($20); CHR$($36);
 0139        PRINT USING "S80^","Hold down the <RETURN> key for demo";
 0169        PRINT CHR$($02); CHR$($20); CHR$($26);
```

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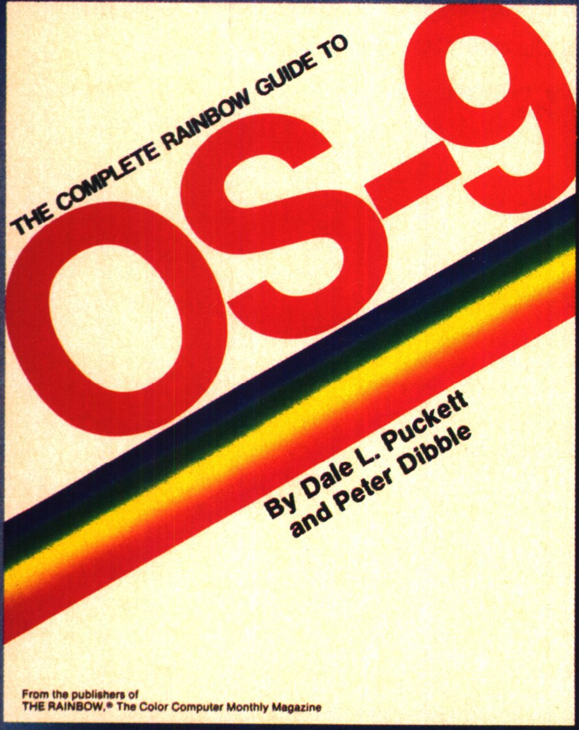
A MILESTONE

THE COMPLETE RAINBOW GUIDE TO OS-9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file on the *Word-Pak II* disk probably were written for Version 1.0 which didn't contain those modules. Just edit "install" and *bootlist* to include the missing modules and I'm pretty sure they will appear. Good luck!

Another gung-ho BASIC09 programmer in the CoCo crowd is Tom Ring in Potsdam, N.Y. Tom sent two tips and a procedure that will give you accurate execution timings. It's called *elapsed*.

Ring passed along this tip which you may not have tried before. Use the global editing capabilities of BASIC09 to your advantage. It can save a lot of wear and tear on your fingers. Imagine that you want to use a long variable name like ElapsedSeconds in a BASIC09 procedure. Why not simply type `ES` and then use BASIC09's global change command. Give it a try.

> ***"When you connect two computers together, you need a null modem cable — a cable that connects the transmit or output line of one to the receive or input line of the other."***

```
E: c* .ES.ElapsedSeconds.  ENTER
```

Also Ring advised that if you are a little tight on memory, you can save 768 bytes when you run BASIC09 by using OS-9's built-in ex command. You'll have to use the Chd and Chx commands after you return from BASIC09, however, because when you run ex, OS-9 throws away the Shell that called it. Here's the command line:

```
OS-9: ex basic09
```

Don't Forget the Null Cable

If you're looking for a public domain communication protocol that gives you error checking and can be used on your Color Computer, Mark E. Sunderlin, a.k.a. Dr. Megabyte, suggests *Kermit*. It runs on more than 200 different machines ranging from the IBM 370 down to the CoCo and lets any two computers transfer text or binary files. Mark uses it to transfer data between his CoCo and a Zilog Z-8000 UNIX system at work. The CoCo version is written in C. You can get all versions from Columbia University in New York City but Mark didn't give us the

```
 017A      REPEAT
 017C        remainder:=MOD(data_inputs,data_lines)
 0188        INPUT "P R O G R A M   D A T A   M A Y   B E   P L A C E D   I N
T H I S   A R E A !"
                                    ,test_string
 01DF        PRINT CHR$($08); "!";
 01EA        IF remainder=zilch THEN
 01F7          PRINT CHR$($02); CHR$($20); CHR$($26);
 0208          PRINT CHR$($1B); CHR$($42);
 0214          FOR count=1 TO 16
 0224            PRINT blank
 0229          NEXT count
 0234          PRINT USING "S80^","Hold down the <RETURN> key for demo"

    ;
 0264          PRINT CHR$($02); CHR$($20); CHR$($26);
 0275        ENDIF
 0277        data_inputs=data_inputs+1
 0282      UNTIL data_inputs=500
 028E      END


PROCEDURE gfxtest
 0000      DIM f,g:INTEGER
 000B
 000C      g=0
 0013 10   PRINT CHR$(15); CHR$(1); CHR$(g)
 0024      PRINT CHR$(20)
 0029      PRINT CHR$(21); CHR$(4); CHR$(0)
 0036      PRINT CHR$(22); CHR$(4); CHR$(g)
 0044      PRINT CHR$(21); CHR$(122); CHR$(95)
 0051
 0052      FOR f=5 TO 95 STEP 5
 0067        PRINT CHR$(26); CHR$(f)
 0071      NEXT f
 007C
 007D      g=g+1
 0088
 0089      IF LAND(g,3)=0 THEN g=g+1
 00A2      ENDIF
 00A4
 00A5      FOR f=1 TO 3000
 00B6      NEXT f
 00C1
 00C2      PRINT CHR$(19)
 00C7      GOTO 10
 00CB
 00CC 100  PRINT CHR$(18)
 00D4
 00D5      REM chr$(18) clears the graphics memory
 00FB      REM RUN, BREAK to exit, RUN 100 to clear gfx memory
 012D


PROCEDURE itype
 0000      PARAM name:STRING[60]
 000C      DIM path:INTEGER
 0013      DIM f:REAL
 001A      DIM char:STRING[1]
 0026      DIM tst:BOOLEAN
 002D
 002E      ON ERROR GOTO 100
 0034      tst=TRUE
 003A      OPEN #path,name:READ
 0046      f=0
 004E
 004F      WHILE tst DO
 0058        SEEK #path,f
 0062
 0063        IF EOF(#path) THEN PRINT
 006E          CLOSE #path
 0074          END
 0076        ENDIF
 0078
 0079        GET #path,char
 0083        f=f+1
 008F
 0090        IF char=CHR$(7) OR char=CHR$(10) OR char=CHR$(13) OR char

   >=CHR$(31) AND char<=CHR$(127) THEN PRINT char;
 00C2        ELSE
 00C6          PRINT "\";
 00CC          PRINT USING "h2",char;
 00D8        ENDIF
 00DA
```

THE X-TEAM FOR OS-9

XTERM

XTERM is a full featured OS-9 communications program that takes full advantage of the power of OS-9. It works with the normal text screen, XSCREEN, or the Wordpak 80 column board.

XTERM is menu oriented for ease of use, it is simple to use even for the novice OS-9 user. And yet, XTERM is powerful enough for the expert OS-9 user.

Some of the features of XTERM include: full upload and download support with remote buffer operation; supports XON/XOFF protocol; 110/300/600/1200 baud, 5/6/7/8 bits, even/odd/no parity, full or half duplex; able to execute an OS-9 shell command from within XTERM.

XTERM works with a Color Computer using the standard serial interface, but also will work with a hardware serial port. Also, if you are using a hardware parallel printer port, you can print data to the printer as it is received.

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XMENU is a system that creates a menu-driven environment for the Color Computer using OS-9. OS-9 now becomes easy-to-use with command selections made from menus. Menus are included to access OS-9 commands. An easy-to-use utility is provided that allows for the creation and maintenance of menus.

XMENU works with XSCREEN, the normal text screen, O-PAK, and the WORDPAK 80-column board.

XMENU 29.95

XSCREEN

XSCREEN creates a high resolution screen for the Color Computer using OS-9. This high resolution screen gives you 24 lines of text with 51, 64, or 85 characters per line. Characters can be either white on a black background or vice versa. Easy menu operation.

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XWORD

XWORD is a powerful word processing system for the Color Computer using OS-9. XWORD is feature packed with only a few features mentioned here.

Some of the editing features of XWORD include: true character oriented full screen editor; works with the normal text screen, XSCREEN, O-PAK, or WORDPAK 80 column card; full block commands with blocks displayed in inverse characters (except with normal text screen) for easy block manipulation; file size not limited to a buffer size; full find and replace commands with wildcard character; able to execute an OS-9 shell command in the middle of editing. Many, many more features, too many to mention here.

Some of the formatting features of XWORD include: proportional spacing supported; perfectly aligned hanging indents and columns, even when using proportional characters; full printer control with control of character size, emphasized, italics, overstrike, underlining (with or without spaces), super and sub-scripts; up to 10 header/footers; page numbering in decimal or Roman numerals; margins and headers can be set differently for even and odd pages; automatically reads printer initialization file to define XWORD for your printer (many included, and easy to write or modify your own). Many more features.

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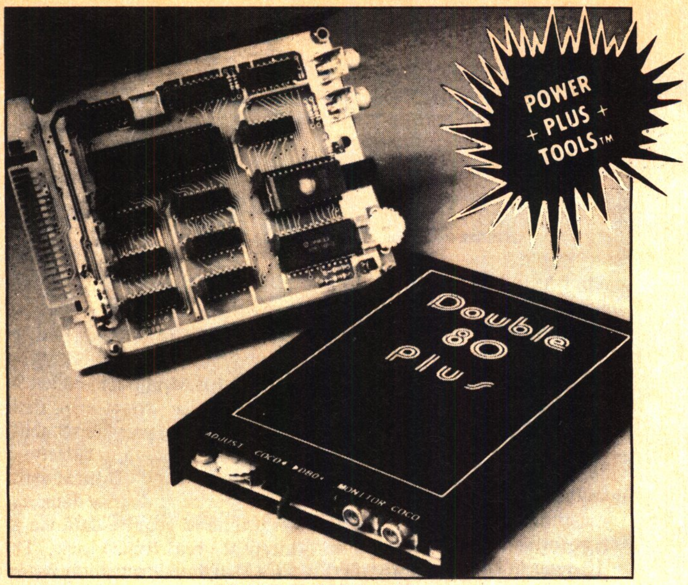

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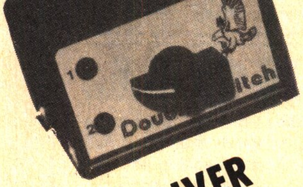

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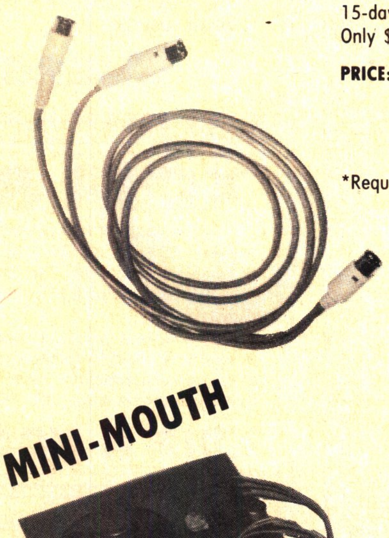

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BAUD Rates:
- 110-4800 (communicate)
- 600-9600 (printer)

Screen Format:
- 80 x 24 upper/lowercase
- Send all 128 characters from keyboard

Buffer:
- Merge text or programs
- 49K to 53K memory
- Four Buffer Send Modes
- Display Bytes Used/Remaining
- Editor—Move forward and reverse thru buffer. Insert, type over, delete lines, characters or words. Block delete.

10 Macro keys
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- Use 1 to 4 Disk Drives (w/SAVE, LOAD, DIR & Granule Display)
- Print while receiving information*
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address, so here's his: 1430 Greystone Terrace, Winchester, VA 22601.

And speaking of communications, Richard Cambell of Havelock, N.C., wrote to ask why he couldn't get his two Color Computers to communicate with OS-9. He uses OS-9 and an RS-232 Pak on one CoCo and wants to use the other as a terminal via its built-in RS-232 port. He says they both can talk to local bulletin boards, but when he connects one to the other — using the same cables — they just sit there.

Here's the problem: Both computers are talking and both are listening, but they aren't talking to each other. Since you mentioned that both machines can talk to local bulletin boards through your modem, we know that the RS-232 ports on both of the Color Computers are working.

The answer: When you connect two computers together, you need to use a null modem cable — a cable that connects the transmit or output line of one to the receive or input line of the other. You can build one by reversing those two wires on the cable you're using with your modem. Or, if you would rather not attack the cable with

```
 00DB       ENDWHILE
 00DF
 00E0       CLOSE #path
 00E6       PRINT
 00E8
 00E9       REM if you want a character count, add the next line
 011C       PRINT "character count="; f
 0134 100   IF ERR=216 THEN PRINT name; " not found"
 0152       ENDIF
 0154       BYE
 0156


PROCEDURE screentest
 0000       (* demonstrates screen controls under coco os9
 002E       (* John Carter - WB4HLZ - Feb. 1985
 0052       DIM f,g:INTEGER
 005D       DIM a,b,c,d:INTEGER
 0070       DIM tst:BOOLEAN
 0077
 0078       tst=TRUE
 007E       (* 12 clears screen, 1 homes cursor without clearing screen
 00B9       PRINT CHR$(12);
 00BF
 00C0       FOR f=1 TO 12
 00D0         PRINT "line "; f
 00DD       NEXT f
 00E8
 00E9       FOR f=1 TO 3000
 00FA       NEXT f
 0105
 0106       FOR f=1 TO 4
 0116         (* 9 is "up one line"
 012B         PRINT CHR$(9);
 0131       NEXT f
 013C
 013D       PRINT "up from 12"
 014B
 014C       FOR f=1 TO 3000
 015D       NEXT f
```

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a soldering iron, Bob Rosen at Spectrum Projects will sell you one.

Communications was also the topic of concern for John Kresin of Port Huron, Mich. He's in a local TRS-80 computer club where his Color Computer is outnumbered by Model IIIs and Model 4s. He really wants to find a bulletin board program for his CoCo. John, see if you can reach Saturn Electronics Company, 62 Commerce Drive, Farmingdale, NY 11735, (516) 249-3388. They advertised an "OS-9 BBS" for $89.95 last summer. If they are out of business, I suggest you put the question on the CompuServe OS-9 SIG as there were several threads discussing bulletin boards for the Color Computer and OS-9 last summer.

Finally, as we wrap up the file named */d/RAINBOW/KISS.June*, here's a note about another new product that hit the stands this month. Computerware is now shipping *Look and Listen* for OS-9. Inside, you'll find the high resolution screen that Brian Lantz developed for their stand-alone *Databank Manager*, a font editor to create characters for it, several sound commands, as well as a device driver and descriptor that lets you use Tandy's Speech/Sound cartridge.

The Speak command in this package is like the standard OS-9 Echo utility, except it sends its output to the Speech Cartridge, i.e., "Speak Hey turkey, you better not delete that file!" On the other hand "Talk" and "Talker," the device descriptor and driver, act just like any other OS-9 device.

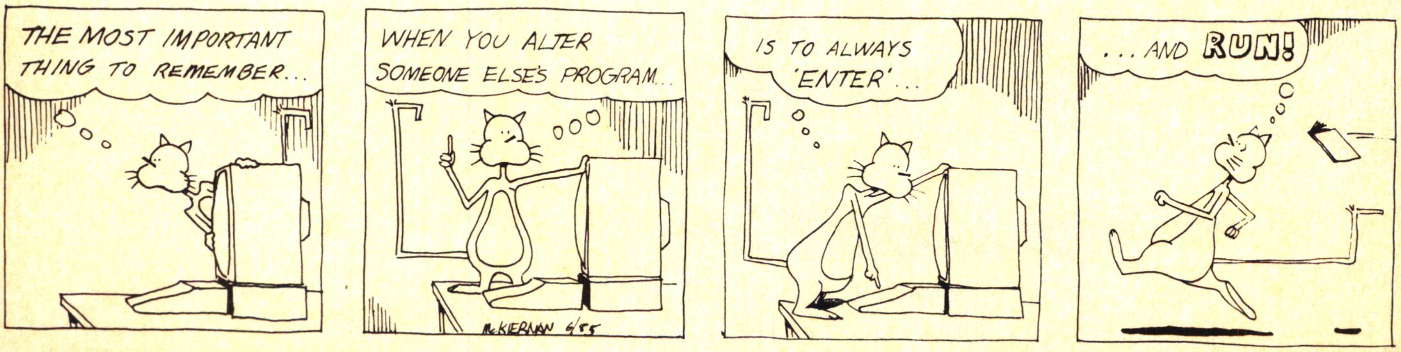
For example, if you want your CoCo to read a listing of the files in your current data directory you need only type this command line:

```
OS-9:dir>/talk ENTER
```

How can the Fourth of July compete? See you then!

```
0168
0169      PRINT CHR$(1); "top line";
017A
017B      (* 10 is LF
0186      FOR f=1 TO 12
0196        PRINT CHR$(10);
019C      NEXT f
01A7
01A8      PRINT "press enter for graphics"
01C4      INPUT x$
01C9
01CA      (* this is the fun part
01E1      (* set 4 color mode [1] - (green background) yellow foreground [1]
0223
0224      RUN gfx("mode",1,1)
0236
0237      (* clear the graphics screen
0253      (* just in case there's something there
027A
027B      RUN gfx("clear")
0288      (* wait a bit
0295
0296      FOR f=1 TO 1000
02A7      NEXT f
02B2
02B3      FOR g=5 TO 35 STEP 5
02C8        RUN gfx("circle",45,95,g)
02E1        RUN gfx("circle",210,95,g)
02FA      NEXT g
0305
0306      (* wait a bit
0313      FOR f=1 TO 4000
0324      NEXT f
032F      (* "alpha" takes you back to the alpha screen
035C
035D      RUN gfx("alpha")
036A      INPUT "press enter to add blue ###es",x$
038F      (* set blue foreground [2]
03A9
03AA      RUN gfx("mode",1,2)
03BC      RUN gfx("line",0,0,255,191)
03D4      RUN gfx("line",0,191,255,0)
03EC      RUN gfx("line",180,12,95,97)
0404      RUN gfx("line",180,181,95,96)
041C      RUN gfx("line",76,180,161,95)
0434      RUN gfx("line",76,12,161,97)
044C
044D      (* wait
0454      FOR f=1 TO 3000
0465      NEXT f
0470
0471      (* 14 is also back to text
048B      PRINT CHR$(14)
0490      PRINT "press enter to add red lines and text"
04B9      PRINT "then press enter again to exit"
04DB      INPUT x$
04E0
04E1      (* set red foreground [3]
04FA      RUN gfx("mode",1,3)
050C      RUN gfx("line",76,181,180,181)
0524      RUN gfx("line",76,12,180,12)
053C      RUN gfx("line",95,96,161,96)
0554      RUN gfx("line",0,0,255,0)
056C      RUN gfx("line",1,191,255,191)
0584      RUN gfx("line",0,0,0,191)
```

COCO CAT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...AND RUN!
McKIERNAN 6/85

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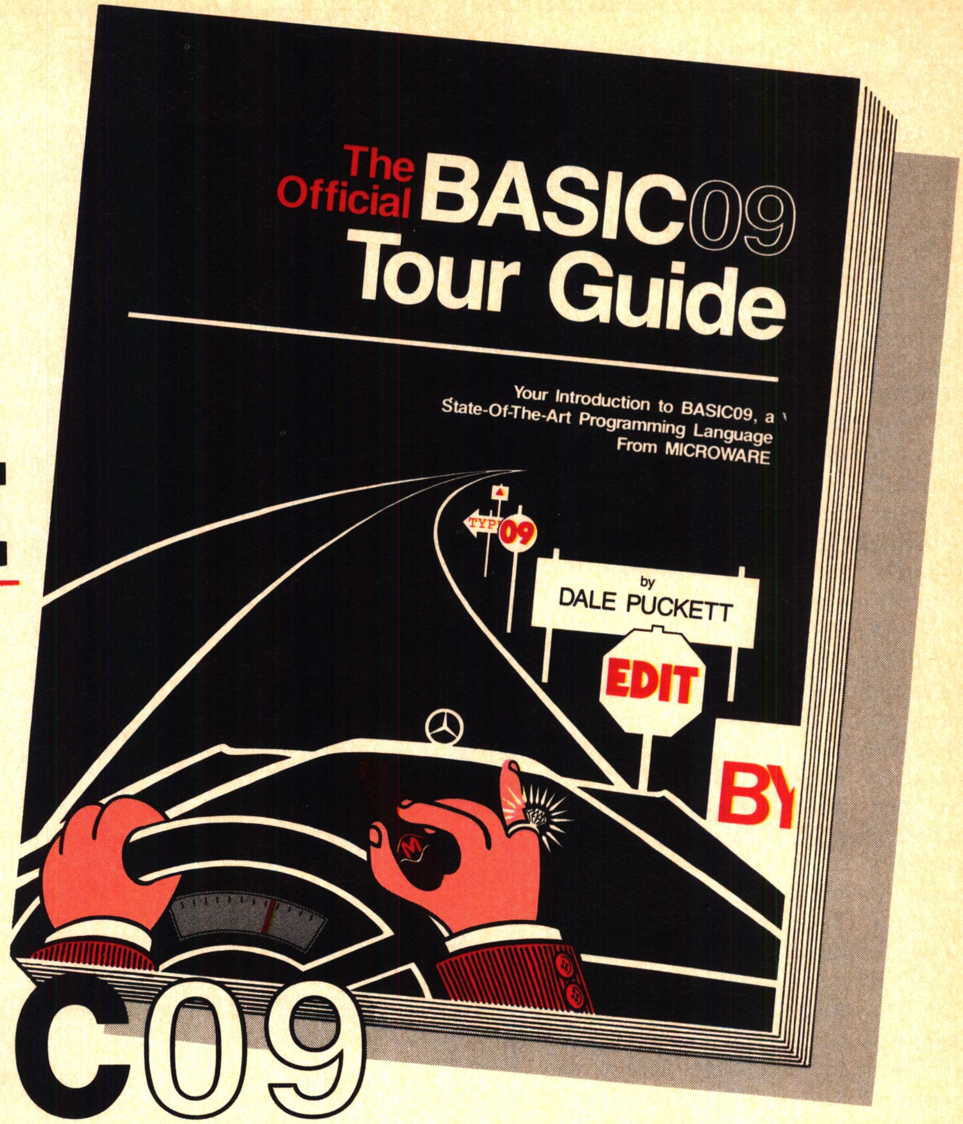
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```
 059C        RUN gfx("line",255,0,255,191)
 05B4
 05B5        (* set yellow foreground for letters
 05D9        (* if mode is '0,1' you get green letters on black background
 0616        RUN gfx("mode",1,1)
 0628
 0629        WHILE tst DO
 0632          READ a,b,c,d
 0643
 0644          IF a=999 THEN GOTO 100
 0654          ENDIF
 0656
 0657          RUN gfx("line",a,b,c,d)
 0677        ENDWHILE
 067B
 067C 100    INPUT x$
 0684        (* "quit" de-allocates the graphics memory
 06AE        RUN gfx("quit")
 06BA        END
 06BC
 06BD        (* data for the letters
 06D4        DATA 4,160,4,188
 06E4        DATA 4,160,12,174,12,174,18,160
 0700        DATA 20,160,20,188
 0710        DATA 24,160,24,188,24,160,36,160
 072C        DATA 24,174,30,174,24,188,36,188
 0748        DATA 42,160,54,160,42,160,42,188
 0764        DATA 60,160,60,188,60,160,72,160
 0780        DATA 60,188,72,188
 0790        DATA 78,160,78,188,78,160,90,160
 07AC        DATA 78,188,90,188,90,160,90,188
 07C8        DATA 96,160,96,188,96,188,108,176
 07E4        DATA 108,176,120,188,120,160,120,188
 0800        DATA 126,160,126,188,126,160,138,160
 081C        DATA 126,188,138,188,126,174,132,174
 0838        DATA 150,188,162,188,156,160,156,188
 0854        DATA 168,160,180,160,168,188,180,188
 0870        DATA 168,160,168,188,180,160,180,188


PROCEDURE type
 0000        PARAM name:STRING[60]
 000C        DIM path:INTEGER
 0013        DIM f:REAL
 001A        DIM char:STRING[1]
 0026        DIM tst:BOOLEAN
 002D
 002E        ON ERROR GOTO 100
 0034
 0035        tst=TRUE
 003B
 003C        OPEN #path,name:READ
 0048        f=0
 0050
 0051        WHILE tst DO
 005A          SEEK #path,f
 0064
 0065          IF EOF(#path) THEN PRINT
 0070            CLOSE #path
 0076            END
 0078          ENDIF
 007A
 007B          GET #path,char
 0085          f=f+1
 0091
 0092          IF char=CHR$(7) OR char=CHR$(10) OR char=CHR$(13) OR char

   >=CHR$(31) AND char<=CHR$(127) THEN PRINT char;
 00C4          ENDIF
 00C6
 00C7        ENDWHILE
 00CB
 00CC        CLOSE #path
 00D2        PRINT
 00D4
 00D5        REM if you want a character count, add the next line
 0108        PRINT "character count="; f
 0120 100    IF ERR=216 THEN PRINT name; " not found"
 013E        ENDIF
 0140        BYE
 0142


PROCEDURE cocodir
```

The RAINBOW

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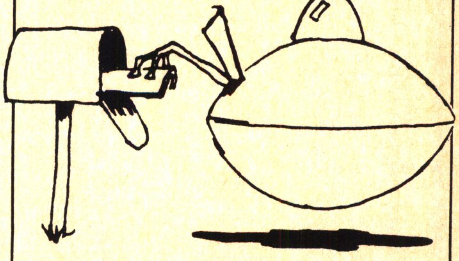

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```
0000        REM
0003        REM programs by John E. Carter - WB4HLZ
0029        REM written as a learning exercise
004B        REM maybe they can be of use to others
0070        REM
0073        REM uses ideas from Mike Dziedzic's "put_dos" program,
00A8        REM which makes an OS9 disk bootable from RS dos under
00DD        REM Disk Basic 1.0 - check the CoCo SIG for the original program
011C        REM
011F
0120        BASE 1
0122        ON ERROR GOTO 1
0128
0129        DIM path:INTEGER
0130        DIM i,k:INTEGER
013B        DIM j,firstchar,file_type,ascii_flag,first_gran:BYTE
0152        DIM number_of_bytes:INTEGER
0159        DIM fat(64):BYTE
0165
0166        PRINT
0168        INPUT "drive = /",disk$
0179
017A 1      REM "dir" to put head on track 0
019C        SHELL "dir /+disk$"
01AB        OPEN #path,"/"+disk$+"@":UPDATE
01BF        REM reading FAT - for future use - to copy rs to os9
01F2
01F3        FOR k=0 TO 63
0203          SEEK #path,307.*256+k
021A          GET #path,fat(k+1)
022B        NEXT k
0236
0237        REM reading directory sectors
0253
0254        FOR k=256 TO 1279 STEP 32
026B          SEEK #path,307.*256+k
0282          GET #path,j
028C          firstchar=j
0294
0295          REM if firstchar=255 we're past the active directory
02C8        EXITIF firstchar=255 THEN
02D4        ENDEXIT
02D8
02D9          REM print the filename.ext
02F2
02F3          IF j>31 AND j<127 THEN
0306            PRINT CHR$(j);
030D
030E            FOR i=1 TO 10
031E              SEEK #path,307.*256+k+i
033A              GET #path,j
0344              PRINT CHR$(j);
034B
034C              IF i=7 THEN
0358                PRINT ".";
035E              ENDIF
0360
0361            NEXT i
036C
036D            REM get the file type - 0,1,2,3
038B            SEEK #path,307.*256+k+11
03A6            GET #path,file_type
03B0            PRINT " "; CHR$(file_type+48);
03BE
03BF            REM get the ascii flag
03D4            SEEK #path,307.*256+k+12
03EF            GET #path,ascii_flag
03F9
03FA            IF ascii_flag=255 THEN
0406              PRINT " A";
040D            ELSE PRINT " B";
0417            ENDIF
0419
041A            IF firstchar>31 AND firstchar<127 THEN
042D              PRINT
042F            ENDIF
0431
0432          ENDIF
0434
0435 10       REM
043B        NEXT k
0446        CLOSE #path
044C        PRINT
044E        END
0450
```

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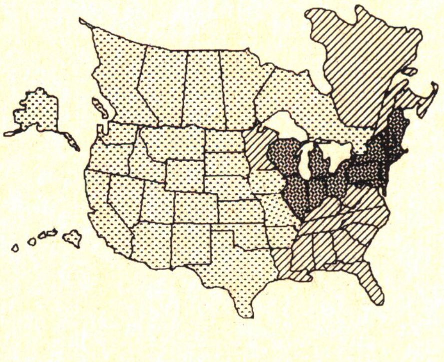

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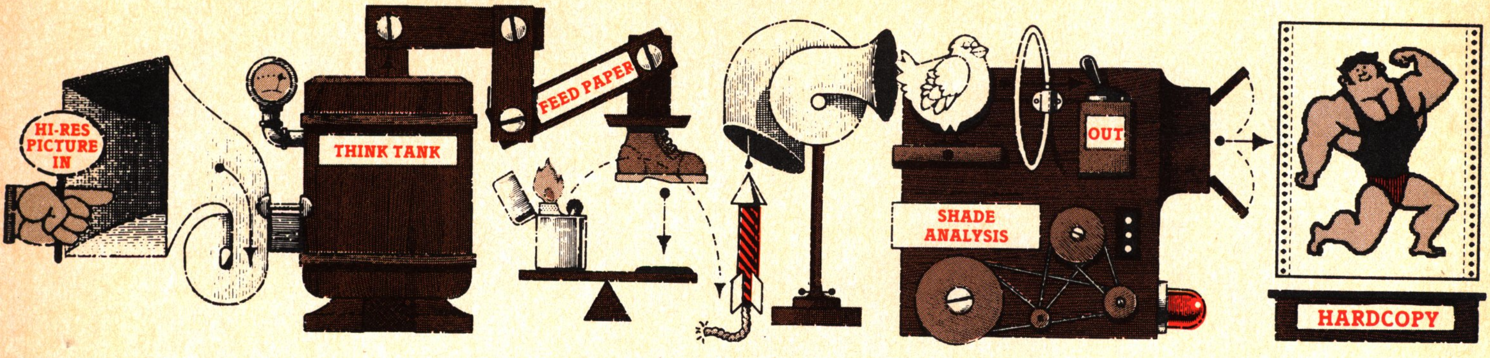
BUT CAN IT WAX FLOORS?



From the folks that brought you GRAPHICOM PART II, comes **HARDCOPY** - The ultimate printer utility. Hardcopy is more than just a screen print utility, compare these features with any other graphic dump program on the market;

- Full GRAPHICOM/GRAPHICOM PART II compatibility! Loads STANDARD 6K images, GRAPHICOM pictures, and COCO MAX pictures too!
- BLACK & WHITE or GREY SCALE printing. In GREY SCALE printing, colors are printed as user definable patterns. Supports hi-res in all 4 GRAPHICOM display modes!

1x, 2x, 3x PRINTOUTS

Three menu options are reserved for the most frequently used printout sizes; 1x (quarter page), 2x (half page), and 3x (full page). The 1x and 2x printouts are right-side-up on the paper, the 3x printout is rotated 90 degrees. The user can select a positive or negative image, hi-res or color interpretation (colors reproduced with user defineable grey scale), and which PMODE the graphic-to-be-printed is usually displayed in.

GREETING CARDS

The greeting card option allows the user to custom design greeting cards using both text and graphics. There are two card styles available, along with a built in "mini-typesetter" (16 different size of text, characters may be rotated, mirrored, inverted, and much more.)

LABELS

The label printing option allows the user to create custom mailing or disk labels with professional looking results. Just load a graphic image from disk, position the proportional label window over the area to be printed. Uses standard 15/16" x 3½" tractor feed adhesive labels. Prints 1-99 labels at a time.

POSTERS

The poster option provides the user with a means of reproducing a hi-res graphic to a multi-sheet poster. Both hi-res and color printing are supported, sizes range from poster-size to mural-size to billboard-size!

HARDCOPY

THE ULTIMATE PRINTER UTILITY

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SPECIAL EFFECTS

The special effects option allows the user to directly control the printing directives; ROTATION, X&Y SIZE, X/Y FLIP, X/Y GRID, X/Y FILL, TAB, WINDOW, POS/NEG IMAGE, and more! With these, the user can print multi-page banners, change the grey levels used in color printing, rotate printouts 90, 180, or 270 degrees, stretch printouts horizontally or vertically, zoom in on small areas, superimpose vertical and/or horizontal grid lines with printouts for measurements and graphing, and much much more.

DISK ACCESS

The disk option provides the user with access to standard 6K images, GRAPHICOM and GRAPHICOM PART II files, and COCO MAX files too! "GALLERY" function allows viewing of all pictures on a disk. Supports 1 to 4 disk drive system.

Have an application that **HARDCOPY** doesn't quite match? You can write it easily yourself! The hard work's been done for you, we've FULLY DOCUMENTED the **HARDCOPY** routines and added them to EXTENDED BASIC through the USR command!

(We decided to leave out the Floor-waxing module to keep the price down.)

HARDCOPY* requires a 64K Color Computer or Color Computer II, and at least one disk drive. It supports 1 to 4 disk drives, keyboard or joystick input, COLOR (grey scale) or B/W (hi-res) operation, 4 screen display modes.

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* Due to hardware differences, some features may function differently on certain printers.

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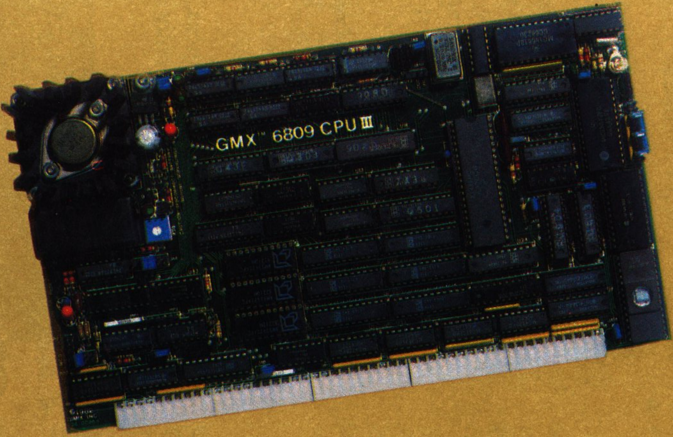
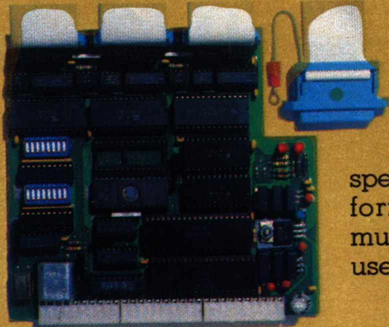
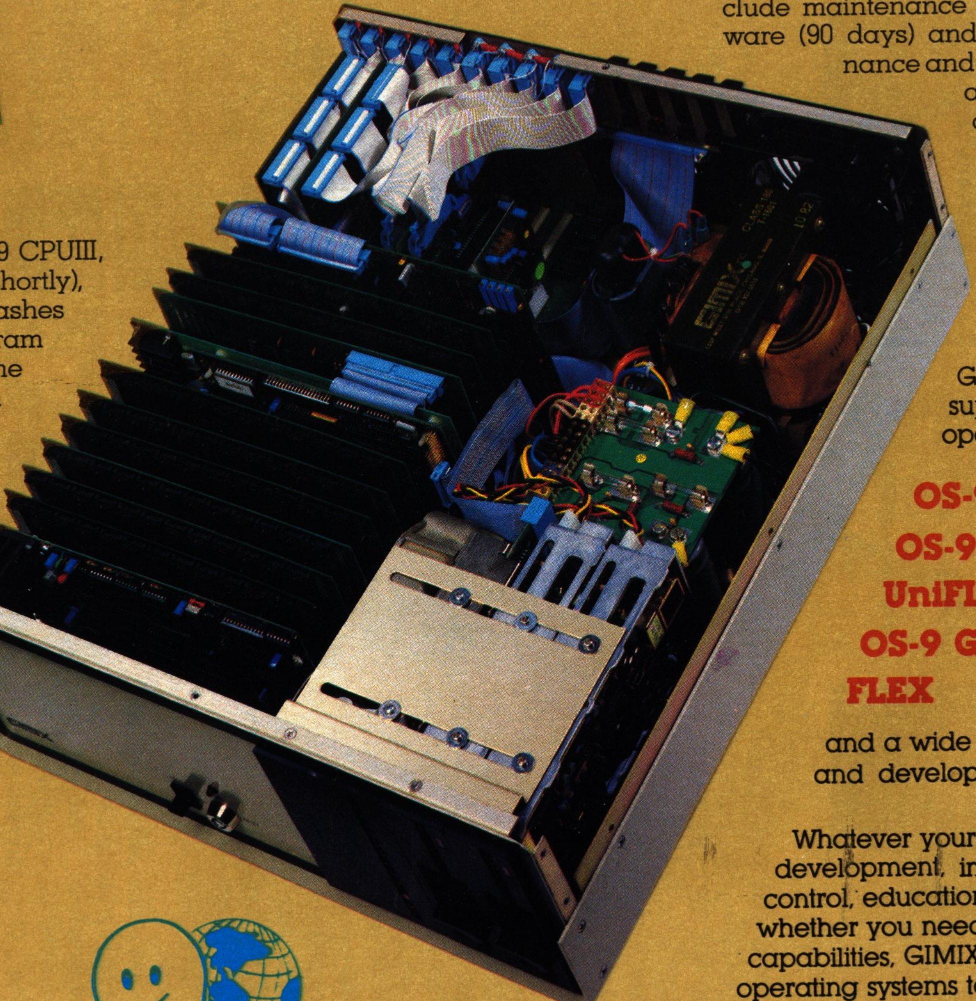


GIMIX has 19MB or high performance 47MB Winchester Drive Systems and/or Floppy Disk Drive Systems.

For the ultimate in performance, the Unique GMX 6809 CPUIII, using either OS-9-GMXIII or UniFLEX GMXIII (available shortly), gives protection to the system and other users from crashes caused by defective user programs. e.g. During program development, a programmer who crashes goes back to the shell or the debugger, while the other users are not even aware anything occurred.

The intelligent serial I/O processor boards significantly reduce system overhead by handling routine I/O functions, thereby freeing up the host CPU for running user programs. This speeds up system performance and allows multiple terminals to be used at 19.2K baud.





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(NOTE: this support and maintenance is only for use with approved GIMIX hardware)

GIMIX 6809 systems support five predominant operating systems:

OS-9 GMX III,
OS-9 GMX II,
UniFLEX,
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and a wide variety of languages and development software.

Whatever your application: software development, instrumentation, process control, educational, scientific or business; whether you need single or multi-user capabilities, GIMIX has hardware and the operating systems to get the job done reliably.

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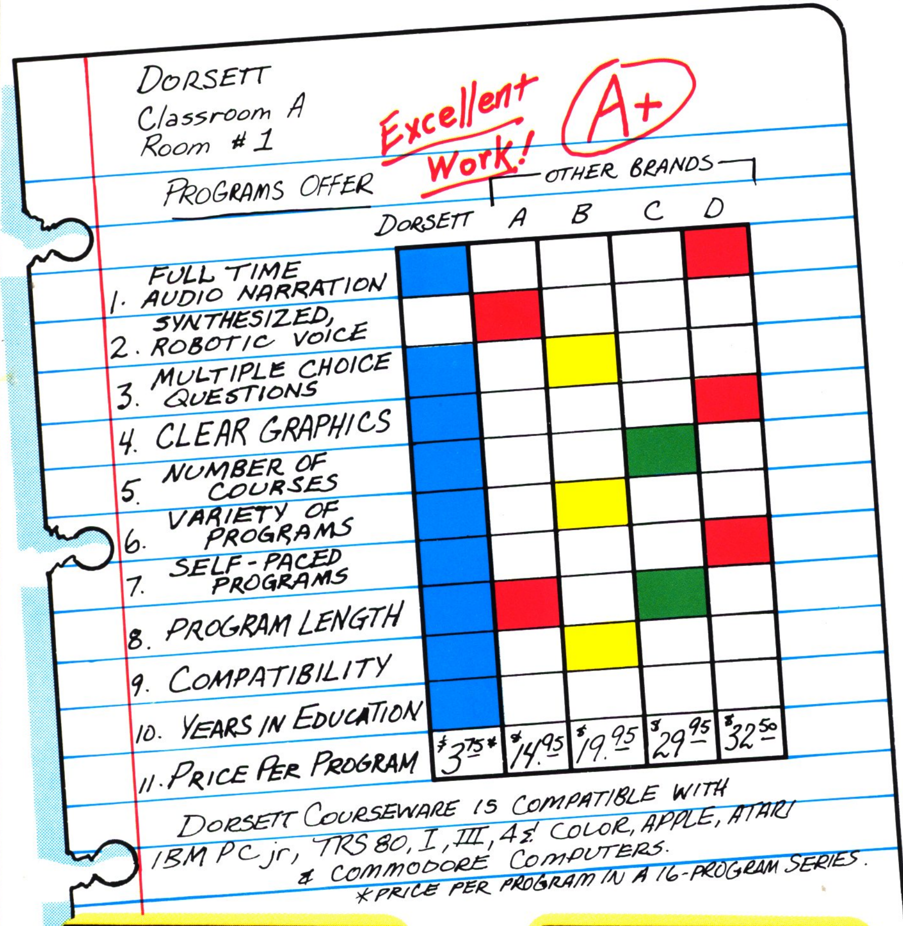

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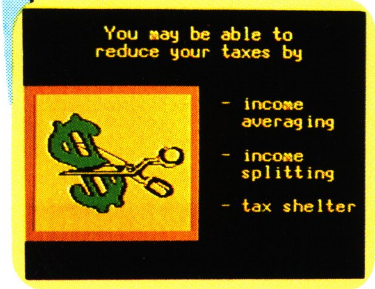
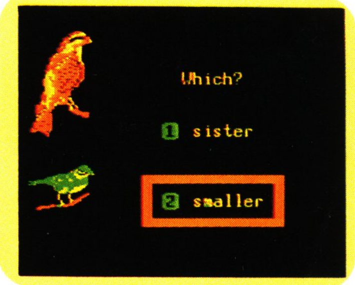
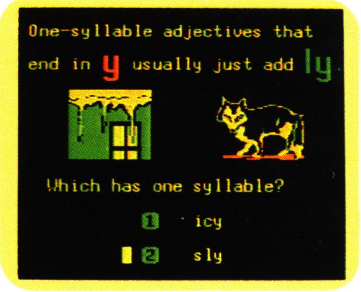


```
You may be able to
reduce your taxes by

- income
  averaging

- income
  splitting

- tax shelter
```



```
Which?

1 sister

2 smaller
```



```
One-syllable adjectives that
end in y usually just add ly.

Which has one syllable?
1 icy
2 sly
```

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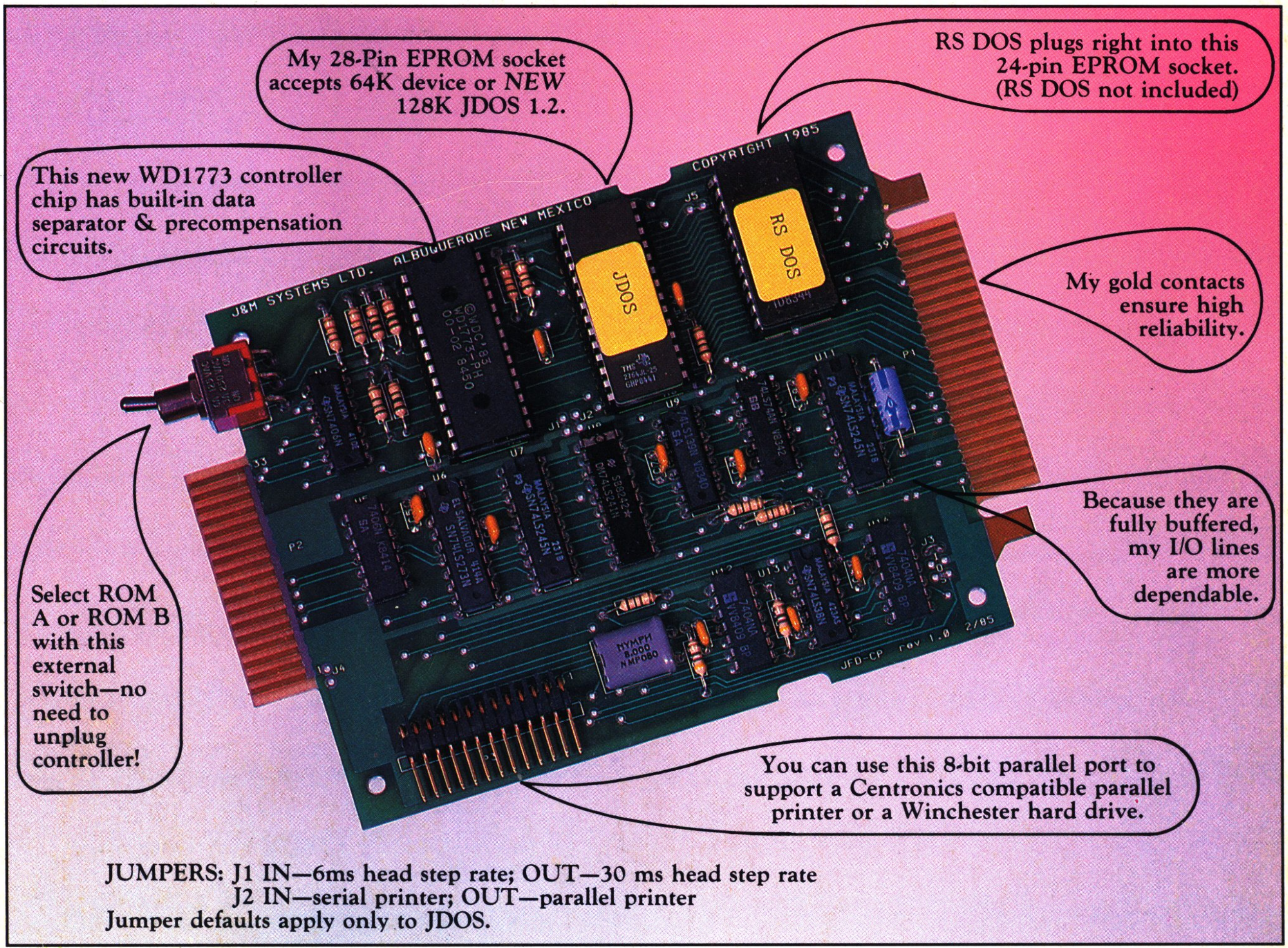

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